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UNITED STATES ATOMIC ENERGY COMMISSION

# Nuclear Science Abstracts

Covering the Literature on Atomic Energy
in the Fields of

Biology Medicine Chemistry
Biophysics Physics Engineering
Metallurgy

Vol. 5 No. 15
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# GENERAL

## ATOMIC POWER

3796

CHEMISTRY AND ATOMIC ENERGY. J. A. Swartout. Chemistry 24, 11-18(1951) Jan.

The role of the chemist and the status of chemistry in atomic energy programs during and after World War II are reviewed, and the chemical problems of the immediate future are discussed briefly in a nontechnical manner.

# BIOLOGY AND MEDICINE

3797

Kansas Univ. Medical School and Washington Univ., St. Louis School of Medicine
HISTOCHEMICAL AND MICROCHEMICAL CHANGES IN EXPERIMENTAL CIRRHOSIS AND HEPATOMA FORMATION IN MICE BY CARBON TETRACHLORIDE. R. E. Stowell, C. S. Lee, K. K. Tsuboi, and A. Villasana. [nd] 35p. (AECU-1305)

Coordinated cytologic, histochemical, and biochemical studies of mouse livers were made at intervals following repeated biweekly feeding with $CCl_4$. Incidence of cirrhosis and hepatomas and their anatomical and histological characteristics are given. Chemical data showed glycogen increase in later stages of cirrhosis and in most hepatomas; lipid content decreased in cirrhosis and hepatomas; cholesterol in the liver decreased during the third to twelfth week in cirrhosis; alkaline phosphatase increased in cirrhosis and even more so in hepatomas; $H_2O$ content was higher in hepatomas than in cirrhosis. Nucleic acid content showed variations. Increased content of nuclei of fibroblasts and inflammatory cells may account for increase in desoxypentose. Histochemically, esterase was increased in cirrhosis and decreased in hepatomas; chemically, variation in all tissues was found. Nitrogen, phosphors, acid phosphatase, and succinoxidase dehydrogenase showed no significant change. A ceroid-like yellow pigment was observed. Heterotopic bone formation in cirrhosis may occur. 10 figures.

3798

Kansas Univ.
PHOSPHOMONOESTERASE ACTIVITY IN HEPATIC TISSUES IN THE MOUSE. K. K. Tsuboi. [nd] 27p. (AECU-1322)

In previous papers aqueous extracts of autolyzed liver have been described as containing enzymes capable of hydrolyzing monoesters of phosphoric acid. The presence of two enzymes referred to as "acid" and "alkaline" phosphatase has been concluded. The present paper presents three general studies: (1) Quantitative methods for the accurate estimation of phosphomonoesterase activity at pH 5.5 and 9.2 within fresh mouse liver tissue homogenates using phenylphosphate as a substrate (optimal substrate concentration, 250 to 500 $\mu$M; magnesium ion concentration 0.12M) are presented. (2) Under these same conditions phosphomonoesterase activity was determined on liver homogenates of normal adult fasted mice and on homogenates of regenerating liver of adult mice subsequent to partial hepatectomy. Although increases in phosphomonoesterase activity were found at pH 9.2 within the regenerating tissues, little differences were observed in enzyme levels at pH 5.5. (3) Centrifugation techniques were applied to investigate the relative distribution of phosphomonoesterase activity. Enzyme active at pH 5.5 appeared to be concentrated within the submicroscopic or microsomal fraction. Little concentration of enzyme active at pH 9.2 was found within any of the sedimented fractions of normal liver; however, a concentration was present within nuclear fractions of regenerating liver. Presence of separate enzymes acting at pH 5.5 and 9.2 seems to be verified by differences found in inactivation, rates, sedimentability, and relative alterations found in regenerating liver.

3799

Kansas Univ. Medical School
HISTOCHEMICAL AND CYTOCHEMICAL STUDIES OF NORMAL AND NEOPLASTIC TISSUES; A CRITIQUE. Robert E. Stowell. [nd] 33p. (AECU-1330)

The need for greater awareness in cytochemistry and histochemistry of the interrelationships of the chemical, physical, physiological, and structural properties of cells and tissues is stressed. Severe criticism is made of some published biochemical research that gives analytical infor-

mation on tissues as a whole instead of in terms of functional and structural units such as concentration and amount of nitrogen, phosphorus, etc., per cell type and component. Another source of error is unjustified use of mean values. The diversity in the individual response of animals and their cells should be investigated. Chemical and physical processes in living cells have not been taken sufficiently into consideration (1) because of failure to see the cell as the usual functional structural unit and (2) because of absence of a sufficient number of satisfactory chemical techniques. Relationships and value of many techniques, including radiant energy techniques, use of living organisms, photometric absorption, and freezing and drying techniques, are discussed in detail. Cytochemical techniques for the study of nucleic acids, enzymes, phosphatases, phosphamidase, and esterase are considered. Many examples of application of these methods in cancer research are given. Increased awareness of the available techniques is needed, and new techniques must be developed. Coordination in utilization of more than one method is needed. In many cases long-term cooperative group research with competent and specialized equipment to facilitate a diversified approach to investigation of cells would be of advantage. 117 references.

3800

Minnesota Univ.
**FREE AMINO-ACIDS IN MOLDY AND NON-MOLDY WHEAT.** (abstract) James E. De Vay. [nd] 1p. (AECU-1334)

The report is reproduced here in its entirety.

Chromatographic analyses of the free amino acids in moldy and nonmoldy hard red spring wheat have shown the presence of aspartic acid, glutamic acid, glycine, serine, alanine, glutamine, threonine, proline, arginine, lysine, histidine, valine, leucine, and/or isoleucine, tryptophan, tyrosine, methionine, cystine, and an unknown ninhydrin-reacting substance unstable to hydrolysis. A decrease in histidine and an increase in serine, alanine, and proline concentrations, relative to the concentrations of the other amino acids present, was caused by increasing the moisture content of nonmoldy wheat and thus allowing mold populations of Aspergillus spp. and Penicillium spp. to develop for 2 weeks. A ninhydrin-reacting compound having the same $R_f$ values in phenol-water and collidine-water as gamma-amino-butyric acid was found in moldy wheat.

3801

Cancer Research Inst., New England Deaconess Hospital and Laboratory of Pathology, Harvard Cancer Commission
**PREPARATION OF TISSUE SECTIONS FOR QUANTITATIVE HISTOCHEMICAL STUDIES.** Margaret W. Holt, Sheldon C. Sommers, and Shields Warren. [nd] 11p. (AECU-1336)

A method for preparing histological tissue sections which avoids leaching of $H_2O$-soluble tissue constituents is described. This method combines the freeze-drying method of tissue preparation with a dry cutting and mounting technique. 12 figures.

3802

Atomic Energy Project, Univ. of California, Los Angeles
**THE EFFECT OF ANTIBIOTICS ON HYALURONIDASES IN VITRO.** Herman Schneiderman, Stella Chavos, and Norman S. Simmons. Apr. 20, 1951. 8p. (UCLA-126)

From a comparative study of the effect of a number of antibiotics on testes and bacterial hyaluronidase in vitro it was found that chloromycetin and potassium penicillin inhibit A-4 Streptococcus hyaluronidase at pH 6.0 and 7.4 in vitro. Chloromycetin is slightly inhibitory to testes hyaluronidase at pH 6.0.

3803

Atomic Energy Project, Univ. of Rochester
**SOME OBSERVATIONS ON THE ROLE OF PHOSPHATASE.** W. F. Neuman, V. DiStefano, and B. J. Mulryan. Jan. 15, 1951. 1p. (UR-149)

The report is reproduced here in its entirety.

Working on the hypothesis that ester phosphate is inhibitory to calcification in the absence of phosphatase, experiments of three basic types were carried out. In the first type of experiment, studies on rachitic bone slices demonstrated that ester phosphate does indeed inhibit calcification when phosphatase is inactivated. In conjunction with this, further experiments were performed to demonstrate the inhibition of the accretion of mineral by ester phosphate in a purely physical system. In experiments of the second type, radioactive glycerol phosphate was synthesized and shown to be adsorbed by the bone mineral. The third type of experiment demonstrated the complexing ability of ester phosphate for calcium. This was accomplished by the addition of varying amounts of Ca to a solution containing glycerol phosphate and sulfate. The foregoing experiments indicate that phosphatase has a threefold role in the calcification process: (1) Phosphatase increases the concentration of free inorganic phosphate as first suggested by Robison. (2) Phosphatase increases the concentration of Ca by destroying ester phosphate, the complexing agent. (3) Phosphatase exerts a protective action by preventing the adsorption of ester phosphate which is inhibitory to the growth of the mineral crystal.

3804

Atomic Energy Project, Univ. of Rochester
**QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950.** Henry A. Blair, Director. Feb. 1, 1951. 137p. (UR-152)

Separate abstracts have been prepared on the following sections of this report: The Effects of Whole Body X-irradiation on the Blood Glucose Levels in Rabbits, p.13-33; Failure of Alpha Tocopherol to Protect Against Radiation Injury in the Rat, p.34-8; Effect of Crude and Crystallized Aureomycin on the Weight of Normal and X-radiated Rats, p.39-43; The Incidence of Bacteremia in the X-radiated Rat, p.44-6; Effects of a Second Large Dose of X-radiation on Dogs Surviving One Dose of X-radiation, p.47-53; The Therapeutic Effect of Aureomycin on Bartonella muris Infection in Rats, p.54-8; The Occurrence of Lymphocytes with Bilobed Nuclei in Cyclotron Personnel, p.59-64; Studies in Prolonged Anesthesia in Swine and Dogs, p.65-75; Development of a Copper Sphere Radiometer, p.76-99; Radium Analysis of Source and Tap Water, p.100-5; Fluoride Content of Public Water Supplies, p.106-8; $ZrCl_4$ Mist Inhalation at 20 mg/m$^3$; Deposition and Retention in Tissues, p.109-16; Educational Program, p.118-34.

3805

Atomic Energy Project, Univ. of Rochester
THE THERAPEUTIC EFFECT OF AUREOMYCIN ON BARTONELLA MURIS INFECTION IN RATS, p.54-8 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. F. Furth and J. K. Scott. Feb. 1, 1951. 5p. (UR-152(p.54-8))

Rats known to carry latent Bartonella muris were given a diet containing aureomycin for a period of 7 days prior to splenectomy and 21 days after splenectomy. These animals failed to develop an active infection during the period the aureomycin was fed or after it was removed from the diet. (auth)

3806

Atomic Energy Project, Univ. of Rochester
STUDIES IN PROLONGED ANESTHESIA IN SWINE AND DOGS, p.65-75 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. H. D. Kingsley, L. Hogg, Jr., J. T. Payne, and J. H. Morton. Feb. 1, 1951. 11p. (UR-152(p.65-75))

Dial in urea-urethane injected into the peritoneal cavity of young Chester White pigs and adult mongrel dogs produces adequate anesthesia for studies of local effects of thermal radiation in the laboratory. The recommended dosage for intraperitoneal injection of Dial in urea-urethane is 75 mg/kg body weight in pigs and 60 mg/kg body weight in dogs. The drug should be used no later than 3 months after its preparation and should be kept refrigerated in the dark. Anaesthesia is produced in 5 to 30 min and can be expected to be adequate for at least 18 hr. Survival can be expected if there is adequate ventilation for the animal, satisfactory injections are made, and the animal is not starved more than 24 hr prior to anesthetization. (auth)

3807

EFFECT OF CANAVANINE ON MUTANTS OF NEUROSPORA AND BACILLUS SUBTILIS. H. J. Teas. J. Biol. Chem. 190, 369-75(1951) May.

The growth response of several mutant strains of Neurospora fungus and B. subtilis bacteria to the amino acid canavanine was studied. One Neurospora mutant was able to grow if supplied with threonine, isoleucine, $\alpha$-aminobutyric acid, homoserine, or canavanine. In this mutant the genetically conditioned resistance to canavanine appears to function by conversion of canavanine to some substance with growth-promoting activity similar to homoserine. The utilization of canavanine in this case was inhibited by arginine or lysine, whereas in a wild-type canavanine-sensitive strain, canavanine inhibition is overcome by arginine or lysine. B. subtilis was not inhibited by canavanine; a strain which required homoserine was able to grow if supplied with canavanine. Canaline showed little or no homoserine activity for either organism and is, therefore, probably not an intermediate in canavanine utilization. (auth)

3808

EFFECTS OF ATROPINE ON BRAIN RESPIRATION. D. J. Cavanaugh. Proc. Soc. Exptl. Biol. Med. 75, 607-10 (1950) Dec.

Atropine in relatively high concentrations inhibited the respiration of rat brain homogenates by as much as 40% under optimal conditions. The respiration inhibition was partially reversible by acetylcholine under certain conditions. The inhibition was pH dependent, increasing with increasing pH. Corresponding changes in the atropine absorption spectrum with varying pH were observed. (auth)

3809

MECHANISM OF ACTION OF VITAMIN P FLAVANOID (RUTIN) ON THE CUTANEOUS CIRCULATION. Alfred A. Schiller. Am. J. Physiol. 165, 293-305(1951) May 1.

A fluorescence photometric method has been used to measure the effect of rutin upon fluorescein transport across cutaneous capillaries of unanesthetized rabbits. It has been shown that rutin produces strong independent cutaneous vasoconstriction and also prolongs epinephrine vasoactivity. Evidence that rutin and epinephrine do not compete for the same receptor has been obtained by administering an adrenergic blocking agent which is without effect on rutin vasoconstriction. It appears that the action of rutin does not depend simply upon a nonspecific antioxidant property. Arterenol action was only moderately prolonged by rutin. In the light of these results, effects of vitamin P on capillary fragility are discussed in relation to its property of strongly constricting minute cutaneous blood vessels. (auth)

3810

MOUSE LIVER NUCLEIC ACIDS. I. ISOLATION AND CHEMICAL CHARACTERIZATION. K. K. Tsuboi and R. E. Stowell. Biochim. et Biophys. Acta 6, 192-201(1950)

Methods for the isolation of pentose and desoxypentose nucleic acids from mouse liver tissue by applying gentle extraction and purification procedures are presented. Differential centrifugation techniques were incorporated to effect a preliminary separation of the tissue into nuclear and cytoplasmic fractions. Chemical analyses indicated that neither nucleic acid conformed to a statistical tetranucleotide in composition. However, near-equal molar proportions of purine nucleotides to pyrimidine nucleotides appeared to be present. Purine analyses disclosed a considerable excess of guanine in relation to adenine for the pentose nucleic acid, and an excess of adenine over guanine in the desoxypentose nucleic acid. A spectrophotometric procedure was described for purine analyses which served to check the chemical methods. Mouse liver pentose nucleic acid was found to be similar to yeast and sheep liver ribose nucleic acids with respect to containing equivalent quantities of dilute acid labile phosphate. Crystalline ribonucleinase was found to hydrolyze the liver pentose nucleic acid incompletely. A preferential hydrolysis of pyrimidine over purine nucleotides by the enzyme was found for the liver nucleic acid as well as for yeast ribose nucleic acid. (auth)

3811

MOUSE LIVER NUCLEIC ACIDS. II. ULTRA-VIOLET ABSORPTION STUDIES. K. K. Tsuboi. Biochem. et Biophys. Acta 6, 202-9(1950).

Alterations in the ultraviolet absorption characteristics of mouse liver pentose and desoxypentose nucleic acids fol-

lowing treatment with acid, alkali, and specific enzyme are demonstrated. Four separate yeast ribose nucleic acid samples showed a consistent increase in absorption by each preparation following acid and alkaline hydrolysis. Extinction values were determined for mouse liver pentose and desoxypentose nucleic acids following specific hydrolytic procedures for purposes of establishing constants for the estimation of these substances by ultraviolet spectrophotometric methods. Investigations dealing with the estimation of nucleic acids in normal mouse liver by spectrophotometric procedures in conjunction with chemical analyses for phosphorus, pentose, and desoxypentose are presented. (auth)

3812

RESEARCH IN NUCLEAR PHYSICS APPLIED TO BIOLOGY AT THE UNIVERSITY OF LIÈGE, BELGIUM. Jean Govaerts. Arch. cent. anticancér. radium-inst. Genève, 1948. 11p. (In French)

A brief summary is presented which is intended to give an idea of the biological studies carried out with radioisotopes and deuterium at the University of Liège since the discovery of artificial radioactivity. A few sentences are devoted to each of numerous studies.

3813

THE SOURCE OF GASTRIC LYSOZYME. Seymour J. Gray, Robert W. Reifenstein, J. C. Gordon Young, Howard M. Spiro, and Edward P. Connolly. J. Clin. Invest. 29, 1595-1600(1950) Dec.

The administration of histamine to normal subjects and patients with peptic ulcer resulted in a profound fall in the concentration and total output of lysozyme in the gastric juice. A significant decrease in the total output of lysozyme was observed in the gastric juice following the intravenous administration of insulin. The mucoprotein fraction of the gastric juice, believed to be derived from the mucoid cells of the gastric gland, was increased by 196 to 334% following histamine stimulation. The mucoproteose fraction of the gastric juice, originating in the surface epithelial cells, was diminished after the administration of histamine. A direct relationship was observed between the concentration of mucoproteose fraction and the lysozyme content of the gastric juice. The gastric juice lysozyme varied inversely with the mucoprotein fraction. The gastric juice of seven patients with pernicious anemia contained a normal lysozyme content with an increased mucoproteose fraction and decreased or absent mucoprotein. Complete absence of acid and pepsin reflected the extensive glandular atrophy of the stomach in these patients. These studies indicate that the surface epithelial cells are the source of gastric lysozyme, and that the parietal, peptic, and mucoid neck cells of the gastric gland do not participate in its production. (auth)

3814

STUDIES ON β-GLUCURONIDASE FROM E. COLI. Henry J. Buehler, Philip A. Katzman, and Edward A. Doisy. Proc. Soc. Expti. Biol. Med. 76, 672-6(1951) Apr.

Potent culture fluid preparations of β-glucuronidase are obtained when E. coli is grown at 25°C and pH 7.3 in a simple medium containing menthyl-β-glucuronide. The optimum incubation time is 8 days when continuous agitation is employed. The optimum pH for the hydrolysis of phenolphthalein mono-β-glucuronide is 6.2, while that for estriol-β-glucuronide is 4.5 to 7.0. Bacterial β-glucuronidase is readily inhibited by ammonium ion. Dialysis markedly decreased the enzymatic activity of the preparations. The culture fluid contains phosphatase but no sulfatase activity. (auth)

3815

STUDIES ON ISOLATED CELL COMPONENTS. I. NUCLEAR ISOLATION BY DIFFERENTIAL CENTRIFUGATION. Karl M. Wilbur and Norman G. Anderson. Expti. Cell Research 2, 47-57(1951) Feb.

A method is presented for isolating nuclei of rat and hamster liver in a state of high purity and in a condition optically similar to nuclei within living cells. The isolation procedure consists in the homogenization and differential centrifugation of fresh liver at 0 to 5°C in a salt-sucrose solution buffered at pH 7.1. By layering the material to be centrifuged over a relatively large volume of a slightly denser solution the purification can be carried out in 4 or 5 centrifugations. The entire procedure can be completed in about 90 min. The yield as determined by measurements of desoxyribonucleic acid is about 5%. The solutions contain $KH_2PO_4$, $K_2HPO_4$, $NaHCO_3$, and sucrose. The sucrose concentration is varied to give density differences required for layering. Salt-sucrose solutions maintain a large proportion of the isolated nuclei in a nongranular condition for 6 hr at 0°C. Pure sucrose is less satisfactory for maintenance. The protein–desoxyribonucleic acid ratio for the isolated nuclei averages 5.1 with a range of 2.7 to 8.9. (auth)

3816

STUDIES ON ISOLATED CELL COMPONENTS. II. THE RELEASE OF A NUCLEAR GEL BY HEPARIN. Norman G. Anderson and Karl M. Wilbur. J. Gen. Physiol. 34, 647-56(1951) May 20.

The addition of heparin to rat liver, kidney, or brain nuclei has been found to bring about the release of a gel. Chemical analysis and histochemical studies on whole homogenates and isolated nuclei demonstrated that the material released by heparin contained desoxyribonucleic acid and protein. The addition of heparin to a finely divided dilute liver homogenate prepared in a phosphate-sucrose solution at pH 7.1 brings about a marked increase in viscosity which reaches a maximum in 6 to 8 min at 23°C and then declines. Fractionation of the homogenate demonstrated that the viscosity increase was due to the presence of the nuclei alone, other components showing no effect. Microscopic observation showed that the increase in viscosity was associated with the appearance of a clear gel around nuclei treated with heparin. No correlation was found between anticoagulant activity of heparin preparations and their effectiveness in causing an increase in the viscosity of liver homogenates. Desulfated heparin produced none of the results described here for heparin.

## RADIATION EFFECTS

3817

Atomic Energy Project, Univ. of Rochester
THE EFFECTS OF WHOLE BODY X-IRRADIATION ON THE BLOOD GLUCOSE LEVELS IN RABBITS, p.13-33 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950 THRU DECEMBER 31, 1950. H. E. Thompson and L. T. Steadman. Feb. 1, 1951. 21p. (UR-152(p.13-33))

Rabbits were irradiated under light anesthesia with 200 kvp x radiation, half-value layer of 1.6-mm Cu. With doses of 500 r and greater, temporary elevations in plasma and red blood cell glucose were observed with a maximum increase at 2 to 4 hr from the start of the irradiation and with a return to normal within 24 hr. The rise in the glucose level increased with the dose and for 1000 r the maximum elevation in the plasma was about 90% and in the red cells about 80%. Animals which were irradiated with a second dose of 500 r between 7 and 33 weeks after the first irradiation showed glucose increase comparable to those receiving a single dose of 1000 r. (auth)

3818

Atomic Energy Project, Univ. of Rochester
FAILURE OF ALPHA TOCOPHEROL TO PROTECT AGAINST RADIATION INJURY IN THE RAT, p.34-8 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. F. W. Furth, M. P. Coulter, and J. W. Howland. Feb. 1, 1951. 5p. (UR-152(p.34-8))

The administration of large amounts of alpha tocopherol or aureomycin just previous to exposure to large doses of x radiation fails to alter the lethality of the irradiation in rats. The experimental method is described, with results shown by a graph.

3819

Atomic Energy Project, Univ. of Rochester
THE INCIDENCE OF BACTEREMIA IN THE X-RADIATED RAT, p.44-6 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. M. P. Coulter, F. W. Furth, and J. W. Howland. Feb. 1, 1951. 3p. (UR-152(p.44-6))

A total of 294 rats received 700 r of whole-body radiation and were sacrificed at intervals postradiation for heart blood culture studies. Blood cultures were obtained on 55 normal rats for control studies. From 20 to 64% of the cultures from radiated rats were positive during the second week postradiation. The greatest mortality also occurred during this period. The organisms recovered were those normally found in the gastrointestinal tract. (auth)

3820

Atomic Energy Project, Univ. of Rochester
EFFECTS OF A SECOND LARGE DOSE OF X-RADIATION ON DOGS SURVIVING ONE DOSE OF X-RADIATION, p.47-53 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. F. W. Furth, M. P. Coulter, and J. W. Howland. Feb. 1, 1951. 7p. (UR-152 (p.47-53))

Nineteen dogs were given two dosages of 450 r of x radiation with intervals of 5 to 12 months between them. Following the first dose of radiation, only 30% of the dogs showed any signs of radiation toxicity, and all dogs appeared normal at the time of the second radiation dose. The erythrocyte and platelet counts after the first dose of radiation returned to normal within 60 to 90 days, but the leukocyte counts returned to only 70% of normal preradiation value. After the second dose of radiation, all the dogs showed signs of severe radiation illness, and only one animal survived. The weight loss was greater after the second dosage of radiation. The rate of fall of erythrocyte, leukocyte, and platelet counts after the second irradiation was essentially the same as after the first. (auth)

3821

ACCUMULATION OF RADIOIODINE IN THE THYROID GLAND OF ELASMOBRANCHS. Endocrinology 48, 485-8 (1951) Apr. (Note)

Emulsion-tissue radioautography has been used to demonstrate that the elasmobranch fishes (sharks and rays) can concentrate I in their thyroids. A 400-$\mu$c dose of $I^{131}$ induced swelling and vacuolation of the cytoplasm of many epithelial cells. Degenerative changes were also visible in the nuclei. The process of cellular degeneration is discussed briefly. 4 plates.

3822

ACTION OF RADIATIONS ON BIOCHEMICAL PROCESSES IN THE LIVING CELL. A. Santos Ruiz. Rev. geofis. 9, 296-316(1950) July-Sept. (In Spanish)

An introductory outline is given of modern views on chemical changes produced by ionizing radiations in living matter.

3823

CATION EXCHANGE IN MAMMALIAN ERYTHROCYTES. III. THE PROLYTIC EFFECT OF X-RAYS ON HUMAN CELLS. C. W. Sheppard and Gertrude E. Beyl. J. Gen. Physiol. 34, 691-704(1951) May 20. (See also NSA 4-2210; 4-5847)

Freshly drawn heparinized human whole blood was exposed to x rays in amounts up to 54,000 r in vitro and then equilibrated under a controlled atmosphere at 24 or 38°C. For as long as 26 hr following exposure K was progressively lost from the cells and quantitatively replaced by Na with little, if any, osmotic disturbance. The mean rate of loss at 20,000 r and 24°C is about 0.4% of the initial cell K per hr and approximately doubles for a 20,000-r increase. It is accentuated if blood is stored at low temperature (5°C) following radiation exposure. Isotope experiments show that the rate of entrance of K into the cells is practically unaltered, the principal effect being an acceleration of the rate from cells to plasma. This suggests that radiation may have interfered with a mechanism of selective K accumulation based on preferential retention of the element. The Na which enters the cells following irradiation contributes to the rapidly exchanging portion of the cellular Na, suggesting that this fraction is ionic Na. (auth)

3824

DAMAGES IN GROWING BONES PRODUCED BY X-RAYS, AND WAYS TO AVOID THEM. Caspar Montag. Strahlentherapie 84, No. 2, 314-24(1951). (In German)

Focal doses of 440 r or more can cause deformations in growing human bones and retardation or cessation of growth. Even 420-r doses produce retardations. On the other hand, no damages are observed with doses of 275 to 300 r, even when repeatedly applied. On the basis of these observations several precautions are recommended, such as the reduction of the single dose and the use of the smallest possible focus skin distance. (auth)

3825

THE EFFECT OF CERTAIN IONS AND OF RADIATION ON CRYSTALLINE TRYPSIN. M. Bier and F. F. Nord. Arch. Biochem. Biophys. 31, 335-6(1951) Apr. (Letter to the editor)

In attempting to stabilize trypsin in solution, it was found that Ca and Mn ions decrease the rate of autodigestion. Other cations and anions had no protective effect. The protective action of Ca was evaluated by means of electrophoretic analysis in addition to the customary methods. The stability of trypsin solutions on exposure to radiation was also investigated. High-intensity electron bursts from a 3-Mev capacitron of about 1-μsec duration were used. The dose causing a loss of activity of 66.7% at pH 2.6 was found to be 75,000 rep units at room temperature and 1,000,000 rep at dry-ice temperature. At pH 8 the required dose increased to 300,000 and 2,200,000 rep units, respectively.

3826

EFFECT OF IRRADIATION AND OF VARIOUS REAGENTS ON VISCOSITY OF NUCLEOPROTEIN SOLUTIONS. Robert N. Feinstein. Proc. Soc. Exptl. Biol. Med. 76, 646-9(1951) Apr.

Cysteine, glutathione, cyanide, and thiocyanate greatly increase the viscosity of alkaline solutions of nucleoprotein (thymus chromosomes), while urea, uracil, thiourea, thiouracil, cystine, and BAL do not do so. Ascorbic acid increases the viscosity only after prolonged incubation. $H_2O_2$ is without effect on the viscosity. If cysteine is added to the alkaline nucleoprotein solution before x irradiation, the expected reduction in viscosity is largely prevented. If the cysteine is added after x irradiation, it is much less effective in this respect. The suggestion is made that these phenomena may be relevant to the question of the mechanism of cysteine and some other agents in increasing resistance of organisms to x-ray lethality. (auth)

3827

EFFECT OF X-IRRADIATION ON INTESTINAL MOTILITY OF THE RAT. Robert A. Conard. Am. J. Physiol. 165, 375-85(1951) May 1.

The effect of x irradiation on intestinal motility of the rat was studied in vivo. Kymographic studies showed that x-ray doses of 100 r and above produced a consistent pattern of intestinal response characterized by a latent period of about 1 min followed by increased tone and motility, the degree and length of tone rise, in general, increasing with dose. Using doses of 800 r x ray, propulsive motility was found to be accelerated during the first hr with a tendency to a decrease below normal from the third hr through the third day and a return to normal after the third day. The most striking feature of both studies was the shortness of the latent period. A study of the influence of various drugs on the response indicated that the action of x irradiation resulted in a stimulation of the cholinergic nerves. The site of action was found to be largely localized in the intestine with little systemic component, and the chief site of action on the vagus appeared to be at the level of the enteric ganglia. (auth)

3828

ENDOTHELIAL DAMAGE BY X-RAYS DISCLOSED BY LYMPH FISTULA STUDIES. R. R. Bigelow, J. Furth, M. C. Woods, and R. H. Storey. Proc. Soc. Exptl. Biol. Med. 76, 734-6(1951) Apr.

The degree of capillary permeability was assayed in dogs and rats by studying the appearance of components of the blood in the lymph. Marked capillary permeability was indicated in dogs and rats exposed to approximately $LD_{50}$ doses of x rays by the appearance of large numbers of erythrocytes in the lymph. The data indicate that the reduced red-cell counts after irradiation are due to the flooding of the lymph compartments and tissue spaces by erythrocytes. The massive erythrophagocytosis and hemosiderosis in sinuses of lymph nodes, if irradiated hosts, indicate that many of the erythrocytes leaving the blood capillaries are destroyed. Loss of erythrocytes caused by capillary damage and death of aging erythrocytes with inhibition of erythrogenesis are the main causes of radiation anemia. (auth)

3829

INDUCED AND OTHER VARIATIONS IN BACTERIAL CULTURES. PART II. GENERAL SURVEY OF CHANGES PRODUCED IN BACT. LACTIS AEROGENES (AEROBACTER AEROGENES) BY ULTRA-VIOLET LIGHT AND SOME OTHER MUTAGENIC AGENTS. A. C. R. Dean and Cyril Hinshelwood. J. Chem. Soc., 1159-68(1951) May.

A general survey is made of the changes induced in Bact. lactis aerogenes by exposure to ultraviolet light, to $\beta$ and $\gamma$ radiation from $S^{35}$, and to certain chemical agents (proflavine and Fenton's reagent). A significant proportion of mutants appears only when the fraction of survivors is very small. The chief effects are reduction in growth rate in a minimal medium, and modification of sugar-fermentation tests. An almost continuous spectrum of behavior is manifested. Specific amino acid requirements seldom appeared and were never absolute with this organism (which is normally very nonselective as regards nitrogen source). (auth)

3830

INFLUENCE OF AGE, BODY WEIGHT, AND SEX ON SUSCEPTIBILITY OF MICE TO THE LETHAL EFFECTS OF X-RADIATION. Herbert L. Abrams. Proc. Soc. Exptl. Biol. Med. 76, 729-32(1951) Apr.

The age at which mice are irradiated profoundly alters their resistance to a single exposure of whole-body irradiation. Mortality is low after irradiation at 1 and 15 days of age, very high at 30 days, and decreases rapidly with increasing age thereafter. The possible mechanisms of this effect are discussed. The response of mice to whole-body irradiation is not related to body weight except insofar as weight reflects a particular age range. In general, sex appears to exert no significant influence on the capacity of mice to withstand whole-body irradiation. (auth)

3831

THE INFLUENCE OF POLYPLOIDY ON THE X-RAY SENSITIVITY OF CELLS. C. J. Bishop. Records Genetics Soc. Am., No. 19, 88(1950)

The report is in abstract form; it is reproduced here in its entirety.

A study of comparative sensitivity to x radiation has been made by treating developing microspores and pollen grains of diploid and tetraploid species of Tradescantia with equal doses of x rays. Treatments were given at a time just previous to the prophase of the pollen grain division and at a stage before chromosome doubling in the generative nucleus division. The aberrations produced were analyzed at the pollen grain division and the pollen tube division, respectively. Results indicate that the sensitivity of the two types of cells is the same if the comparison is based on the number of x-ray-induced breaks per chromosome. A comparison of the number of breaks per cell shows that the cells from the tetraploid plants have approximately double the number of breaks found in those from the diploid plants.

3832

IRRADIATION PRODUCED RISE IN BLOOD RADIOIODINE CONCENTRATION FOLLOWING INGESTED THERAPEUTIC DOSE FOR METASTATIC THYROID CARCINOMA. S. M. Seidlin, A. Aaron Yalow, and Edward Siegel. Proc. Soc. Exptl. Biol. Med. 76, 711-14(1951) Apr.

Four to 8 days after ingestion of therapeutic doses of $I^{131}$ (50 to 200 mc) by patients with metastatic thyroid carcinoma, a rise occurs in blood radioiodine concentration which the authors attribute to irradiation damage to the thyroid gland or thyroid tumor tissue. This increase is termed the irradiation-produced rise (IPR). In a series of patients the magnitude of the IPR in general has been found to increase during radiation thyroidectomy with the quantity of radioiodine retained by the thyroid. In a given patient the magnitude and incidence of the IPR decrease with successive doses as functioning thyroid tissue is progressively destroyed. Finally, when there is no longer any functioning tissue, as demonstrated by absence of $I^{131}$ uptake, the blood radioiodine concentration rapidly falls to very low levels and there is no IPR. (auth)

3833

LIFE SPAN OF WHITE BLOOD CELLS AS MEASURED IN IRRADIATED PARABIOTIC RATS. Donald C. Van Dyke and Rex L. Huff. Am. J. Physiol. 165, 341-7(1951) May 1.

It has been observed that after destruction of the leukopoietic tissues of one member of a parabiotic pair by irradiation the irradiated animal will maintain a low level of leukocytes in the circulation as a result of the blood received from the normal member of the pair through the vascular anastomosis. The amount of blood exchanged by such animals was measured and from this the total number of leukocytes introduced into the blood of the aleukopoietic member was calculated. The relation between the number of leukocytes introduced into the blood stream and the level of leukocytes maintained in the blood stream allowed calculation of the average life time of the leukocyte in the blood vascular system. These studies indicated that the average survival time of the mononuclear leukocytes in the blood of an irradiated parabiotic rat was 170 min while the average survival time of the polymorphonuclear leukocytes was 23 min. (auth)

3834

RESEARCH AND DISCUSSION ON DIFFERENT MECHANISMS OF RADIATION ACTION IN SOME BIOLOGICAL SYSTEMS. Wolfgang Huber. Naturwissenschaften 38, 21-9(1951) Jan. (In German)

An investigation is described of the action of high-intensity electron bursts on various biological targets, viz., microorganisms, viruses, ferments, vitamins, etc. The radiation, obtained from a capacitron accelerator, consisted of intermittent bursts of 0.1 to 100 $\mu$sec duration, the energy of each burst varying between $10^8$ and $10^9$ rep. The sterilization, inactivation, and other responses of the targets were generally obtained with smaller doses than those required in the case of other radiations ($\alpha$, $\beta$, $\gamma$, x). This circumstance permitted the observation that reproductive functions of cells are impaired by the chemical action of ionizing radiations on the nucleic acid molecule, the required dose being equal to only a few hundred rep. As a main result, the experiments showed that in any reaction of biological objects to radiations, dose and dose efficiency cannot be considered alone; accompanying factors such as temperature, medium, and atmospheric conditions play their part.

## RADIATION HAZARDS AND PROTECTION

3835

Brookhaven National Lab.
THE THEORETICAL GROUND-LEVEL DOSE-RATE FROM THE RADIOARGON EMITTED BY THE BROOKHAVEN REACTOR STACK. Philip H. Lowry. July 1950. 33p. (BNL-81)

By a combination of theory and experimental data obtained from oil-fog concentration measurements, an approximate solution to the problem of determining dose rate from the $A^{41}$ emitted by the Brookhaven Laboratory reactor stack has been obtained. The solution is believed to be valid under nearly all meteorological conditions. It is in the form of isodose templates which give the mean value of the dose rate over an area 1 km by 10 deg, extending from the chimney base for a radial distance of 15 km, and averaged for 1 hr. The templates have been constructed for a wide range of weather conditions, including all the major types expected to occur in the Laboratory area. 24 figures. (auth)

3836

Metallurgical Lab., Univ. of Chicago
MEDICAL SERVICES OF THE PLUTONIUM PROJECT;

[NNES, DIV. IV, VOL. 20, PART A, CHAP. 1]. John E. Wirth. July 24, 1946. 24p. (CH-3543)

The philosophy and organization prior to Jan. 1, 1946, of the medical services of the University of Chicago Metallurgical Laboratory, the Clinton (Oak Ridge) Laboratories, and the Hanford Engineer Works are described. The nature of the preemployment physical examination and criteria for acceptance or rejection of personnel are discussed, together with dispensary care, clinical laboratory facilities, liaison between the sites, and record forms. The types of special hazards are mentioned, and clinical manifestation of radiation damage in skin, blood, and urine are considered briefly with a view toward monitoring personnel.

3837

Atomic Energy Project, Univ. of California, Los Angeles
THE BORON AND LITHIUM CONTENT OF HUMAN BONES. R. E. Nusbaum, N. S. MacDonald, G. V. Alexander, Florita Ezmirlian, and Patricia Spain. Apr. 27, 1951. 14p. (UCLA-129)

Spectrographic analyses have been made on 116 ashed samples of bone from 33 human individuals. The values found for B ranged from 16 to 138 ppm by weight, with a mean of 61 and a standard error of ±1.7 ppm. No Li was found in any of the specimens, although the technique was capable of detecting 11 ppm. Computations of the kinetic energy which would be liberated within bone tissue upon exposure to thermal neutrons were made. Though normally present in small quantity, by virtue of its large capture cross section B would contribute significantly to the total amount of ionizing radiation generated by neutron-capture processes. The magnitude of this quantity of energy would be about 1.3 times that arising from the capture of neutrons by the N present in the bone. Although Li also possesses a large capture cross section, the amounts present in normal bone would give rise to less than 0.06 of the energy attributable to the N content. (auth)

3838

Atomic Energy Project, Univ. of Rochester
THE OCCURRENCE OF LYMPHOCYTES WITH BILOBED NUCLEI IN CYCLOTRON PERSONNEL, p.59-64 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. M. Ingram. Feb. 1, 1951. 6p. (UR-152(p.59-64))

The incidence of lymphocytes with bilobed nuclei in the blood of cyclotron workers is reviewed for the period extending from July 1948 through October 1950. An increase in the incidence of the unusual lymphocytes in the group as a whole occurred during the early periods of cyclotron operation. The construction of a protective earth and concrete dike between the cyclotron building and the cyclotron laboratory was followed by a return of the incidence of lymphocytes with bilobed nuclei to approximately normal levels. The significance of the relationship between an increased incidence of lymphocytes with bilobed nuclei and exposure to very small doses of radiation from the cyclotron is discussed briefly.

3839

Atomic Energy Project, Univ. of Rochester
RADIUM ANALYSIS OF SOURCE AND TAP WATER, p.100-5 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. J. B. Hursh and A. A. Gates. Feb. 1, 1951. 6p. (UR-152(p.100-5))

Water samples (source and tap) were collected from 18 cities in the western part of the United States and measured for Ra content. The Ra content of the source water ranged from about $20 \times 10^{-16}$ to $0.3 \times 10^{-16}$ g of Ra/ml and for the tap water from about $3 \times 10^{-16}$ to $0.3 \times 10^{-16}$ g of Ra/ml. (auth)

3840

Atomic Energy Project, Univ. of Rochester
EDUCATIONAL PROGRAM, p.118-34 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. J. N. Stannard. Feb. 1, 1951. 17p. (UR-152(p.118-34))

Lecture and laboratory outlines for the course in Industrial Hygiene and Toxicology, given during Fall 1950; a general description of courses to be given in Industrial Medicine, with a specific outline of the one given in Fall 1950; "The Diagnosis and Treatment of Occupational Disease"; an outline of a 1-week course for nurses, "Medical Aspects of Atomic Warfare"; and an outline of a lecture series and related experiments on radiation physics and dosimetry for residents in radiology are presented.

3841

THE DETECTION OF RADIATION HAZARDS: INSTRUMENTS AND PERSONNEL. William F. Bale. Radiology 56, 656-60(1951) May.

The ideal characteristics of a $\gamma$-ray survey meter are stated. Such an instrument is not yet available, nor is there any instrument which is calibrated for both $\beta$ and $\gamma$ intensities. G-M counters are satisfactory for testing $\beta$ activity in food and water. Two types of personnel dosimeters are needed, one for casualty segregation purposes and one for disaster relief workers. A description is given of a simple, inexpensive radiation-detection gadget which might prevent panic if distributed widely.

3842

PRELIMINARY SUGGESTIONS FOR ADDITIONAL TEACHING IN RADIOLOGICAL ASPECTS OF ATOMIC DEFENSE. Roger A. Harvey. Radiology 56, 653-5(1951) May.

The supplying of undergraduate medical students with basic information about atomic medicine is considered. The author lists specific topics which should be covered and assigns them to specific departments of instruction. Suggestions are made as to methods of presentation. Also included are lists of source materials, extramural agencies which might collaborate, and films for radiologic defense together with their places of procurement.

3843

TOLERABLE RADIATION DOSES. Larkin Kerwin. Laval méd. 16, 489-505(1951) Apr. (In French)

Based on a discussion of the action of x rays on human blood, lungs, skin, and genital organs, a critical examination is made of the problem of minimum harmful doses and maximum security factors. It is concluded that the

maximum daily dose of 0.1 r, often accepted as tolerable, produces observable effects and, if multiplied by a factor of only 5, can become damaging. 32 references.

3844

UPTAKE AND RETENTION OF FIXED CARBON IN ADULT MICE. Donald L. Buchanan. J. Gen. Physiol. 34, 737-59 (1951) May 20.

Mice were continuously exposed to air containing $C^{14}O_2$. The specific radioactivities of urea C, total fecal C, and numerous components of tissue C were compared as a function of the duration of exposure with the radioactivity of the air $CO_2$. The data indicate that the total $CO_2$ fixed from the air is proportional to its concentration in the air. The rates of uptake at the beginning of the exposure and the rates of loss at the termination of the exposure differed strikingly among the tissues studied. However, the ultimate ratio of fixed air-$CO_2$ C to total C in these tissues seemed to be approaching limiting values which would not vary by more than a factor of 3 from one another. It appears that of the total organic C in an adult mouse, approximately 0.01% may originate directly from the $CO_2$ of the air when the animal respires in air having a $CO_2$ concentration of 0.03%, and that 1.8% or more of the total C may originate from $CO_2$ within the animal. Data are presented which indicate the life span of the mouse erythrocyte to be 49 days. The continuous permissible level for mice is given as 31 $\mu c/m^3$. 28 references.

RADIATION SICKNESS

3845

Atomic Energy Project, Univ. of Rochester
EFFECT OF CRUDE AND CRYSTALLIZED AUREOMYCIN ON THE WEIGHT OF NORMAL AND X-RADIATED RATS, p.39-43 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. F. W. Furth, M. P. Coulter, and J. W. Howland. Feb. 1, 1951. 5p. (UR-152 (p.39-43))

Aureomycin administered orally in either the crude or crystalline form failed to increase the weight gain of normal or x-irradiated rats, although the incidence of diarrhea in the x-irradiated rats was markedly diminished. (auth)

3846

THE BIOLOGICAL ACTIVITY OF A FLAVONOID (VITAMIN "P") COMPOUND. Boris Sokoloff, Walter H. Eddy, and James B. Redd. J. Clin. Invest. 30, 395-400(1951) Apr.

A flavonoid preparation from citrus fruit and containing four identified factors was tested, experimentally and clinically, on its biological activity. In addition to demonstrations of protective action against leukotaxine and bacterial polysaccharide, it was shown that the flavonoid gave a considerable but not complete protection to rats against a total-body, near-lethal dose of x radiation. Ninety-two human patients, undergoing deep x-ray therapy and given the mixed flavonoids, 300 to 600 mg/day orally, for 5 days prior to the exposure and during the whole period of radiotherapy, manifested considerable diminution in radiation erythema of the skin and in some cases a complete absence of erythema. Nausea and vomiting, however, persisted in some of the treated patients.

3847

IRRADIATION DAMAGE TO MICE. Oscar Felsenfeld, Sachiko Janet Ishihara, Thora Waters, and Jeannette Norsen. Lab. Digest 14, No. 10, 18-19(1951) Mar.

Experiments were conducted to examine the influence of some antibiotics on radiation sickness in mice. The results show that the number of surviving animals after the irradiation, which was an approximate of $LD_{80}$, was significantly increased when given Neomycin, Glucomycin, Neobacin, or Prodigiosin in doses which would be well-tolerated by humans. Thus oral treatment of bacteremia resulting from total-body irradiation is possible.

RADIOTHERAPY

3848

Ohio State Univ.
RADIOACTIVE COBALT 60 IN PLASTIC TUBING FOR INTERSTITIAL RADIATION THERAPY. Joseph L. Morton, George W. Callendine, Jr., and Wm. G. Myers. Dec. 14, 1950. 12p. (AECU-1318)

The preparation of flexible plastic threads containing small cylinders of radioactive $Co^{60}$ is described. This technique makes it possible for the therapist to sew sources of $\gamma$ radiation averaging 1.2 Mev into any treatment site that can be reached by a needle, either directly from surfaces of the body or during surgical procedures. Upon completion of treatment the radioactive threads are removed like sutures. Because of the flexuous properties of the radioactive nylon threads, patients are more comfortable following implantation than they would be with rigid needles. A more uniform and effective pattern of radiation can be achieved by the therapist by the use of these new sources.

3849

Atomic Energy Project, Univ. of California
NON-UNIFORM FILTER TO PRODUCE A FLAT ISODOSE SURFACE OF X-RAY INTENSITY. M. A. Greenfield and Katherine Hand. Apr. 26, 1951. 10p. (UCLA-128)

A method for constructing a nonuniform filter to produce a flat isodose surface of x-ray intensity is described. Design data are given for a filter constructed in this laboratory. A check of x-ray intensity in a plane showed that it was uniform to within 2 to 3%. (auth)

3850

TREATMENT OF LEUKEMIA WITH ARTIFICIAL RADIOACTIVE SODIUM. A PRELIMINARY REPORT. Jørgen E. Thygesen, Aage Videbaek, and Irgens Villaume. Acta Radiol. 25, No. 4, 305-16(1944).

The authors report the treatment of seven cases of chronic lymphatic leukosis with intravenous injections of a solution of $Na^{24}$, resulting in marked effect on the white blood cell count except in one of the cases, which also proved resistant to later roentgen treatment. At the same time the condition

of the patients improved both subjectively and objectively; but the number of cases is too small, and the observation time yet too short to warrant any definite expression as regards the duration of the effect. In two of the cases both the subjective and objective improvement has, however, been manifest for several months. Besides these seven cases, a case of polycythemia vera was treated with $Na^{24}$, with only slight, passing effect. The clinical therapeutic trial of the method was preceded by merely orientating experiments on mice (transplanted spontaneous leukosis). The authors think that altogether the preliminary results justify further trials on a broader basis. (auth)

## TOXICOLOGY STUDIES

3851

Cincinnati Univ. Coll. of Medicine
OSTEOGENIC SARCOMA AFTER INHALATION OF BERYLLIUM OXIDE. Frank R. Dutra, Edward J. Largent, and James L. Roth. [nd] 13p. (AECU-1272)

A rabbit that had been exposed repeatedly to an atmosphere containing BeO died of osteogenic sarcoma 17½ months after the last day of exposure. The primary tumor was in the left pubis, and there were widespread visceral metastases. Similar tumors are readily produced by the intravenous injection of poorly soluble compounds of Be. Since such tumors have not been observed as a spontaneous condition in our rabbits, it is believed that this sarcoma resulted from the Be compound that was inhaled by this animal. Comparison of the concentrations of Be in normal bone of the rabbit that developed the tumor and in patients who have died of berylliosis forms a basis for concluding that osteogenic sarcomas may eventually develop in some persons who have sustained respiratory exposures to poorly soluble compounds of Be. (auth)

3852

Atomic Energy Project, Univ. of Rochester
$ZrCl_4$ MIST INHALATION AT 20 mg/m³; DEPOSITION AND RETENTION IN TISSUES, p.109-16 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. C. J. Spiegl and M. C. Calkins. Feb. 1, 1951. 8p. (UR-152(p.109-16))

The deposition and retention of Zr was studied in a total of 65 animals (rats, guinea pigs, rabbits, cats, and dogs) exposed by inhalation to a mist of $ZrCl_4$ ($ZrOCl_2$) at a concentration of 20 mg/m³, which produced little or no toxicity in any species. Exposure lasted for 60 calendar days (270 hr). The animals were sacrificed and samples were taken for spectrographic analysis of selected tissues. The lung and pulmonary lymph node were found to contain 55 to 361 μg of Zr/g; these values were approximately 100 to 1000 times higher than were found for kidney, liver, or femur. A serial study of rats showed rapid deposition and slow elimination of Zr by the lung. Mobilization from the lung appeared to take place via the pulmonary lymph node. There is a suggestion of a species difference either in the deposition or mechanism of mobilization of Zr from the lung. (auth)

3853

ACTION OF BERYLLIUM ON CELLS CULTIVATED IN VITRO; EFFECT ON MITOSIS. M. Chèvremont and H. Firket. Nature 167, 772(1951) May 12. (Letter to the editor)

An investigation has been made of the effect of beryllium sulfate acting for 1 to 4 days on tissue cultures of connective tissues and skeletal muscle. Results prove that inhibition of growth and mitotic abnormalities are produced by long contact with Be ions. The histochemistry of alkaline phosphatase, desoxyribonucleic acid, and ribonucleic acid was also studied.

3854

BIBLIOGRAPHY ON BERYLLIUM HEALTH PROBLEMS. N. W. Bass. Am. Ceram. Soc. Bull. 30, 79-80(1951) Mar.

A list of 46 articles and 3 books pertaining to Be toxicology is presented.

3855

CHANGES IN THE SERUM LIPIDS OF RABBITS WITH ACUTE URANYL NITRATE POISONING. Frederick C. Bauer, Jr., Grant C. Johnson, Lynn Carbonaro, and Edwin F. Hirsch. Arch. Path. 51, 441-5(1951) Apr.

Uranyl nitrate poisoning in rabbits was associated with transient azotemia and lipemia of 2 to 3 weeks' duration. All lipids participated in this increase, but the greatest increase was in the neutral fat fraction. The nonprotein N returned to near the control level several days before the lipids. The significance of these results with other forms of nephritis is discussed. (auth)

3856

FACTORS INFLUENCING FLUOROACETATE POISONING. PRACTICAL TREATMENT WITH GLYCEROL MONOACETATE. Maynard B. Chenoweth, Alexander Kandel, Linares B. Johnson, and Donald R. Bennett. J. Pharmacol. Exptl. Therap. 102, 31-49(1951) May.

The ability of various chemical substances to prevent or reverse the toxic effects of sodium fluoroacetate has been studied in mice, rats, rabbits, dogs, and rhesus monkeys (Macacca mulatta). Commercially available monoacetin containing about 60% glycerol monoacetate has been found to be superior to any other substance yet tested for general use against fluoroacetate poisoning. Certain characteristics of its action are described. Various factors such as water and electrolyte imbalance are assigned distinct, but minor, roles in the development of the phenomena of fluoroacetate poisoning. The ability of fluoroacetate to potentiate the depressant action of barbiturates has been observed, and the autoprotective effect in rats has been further clarified. An outline is presented, based on experiments with monkeys, which may be helpful for the guidance of those treating human fluoroacetate poisoning. (auth)

## TRACER APPLICATIONS

3857

Tennessee Univ.
QUARTERLY PROGRESS AND WORK ACCOMPLISHMENT REPORT FOR QUARTER ENDING DECEMBER 31, 1950;

AGRICULTURAL RESEARCH PROGRAM. Mar. 5, 1951. 18p. (ORO-27)

Brief summaries of administrative activities and farm and laboratory operations are followed by brief progress and work-accomplishment reports by projects. Results of studies of relative turnover of $Ca^{45}$ in tissues of bovine fetuses and dams are tabulated. Two groups of week-old chicks were injected intraperitoneally with inorganic $Co^{60}$ and vitamin $B_{12}$ labeled with $Co^{60}$, respectively, and sacrificed at intervals over a 24-hr period. The distribution of $Co^{60}$ observed was in general agreement with values reported by other workers with the exception of that for the liver, which was much lower. The vitamin $B_{12}$ was retained to a greater extent than $Co^{60}$ as evidenced by lower excretion and, in general, higher concentration values in the tissues. Moreover, the turnover rate of vitamin $B_{12}$ appeared to be slower than that of inorganic cobalt, especially in the spleen. Information on other projects is primarily of an operational nature.

3858

Atomic Energy Project, Univ. of California, Los Angeles
HEME SYNTHESIS AND ERYTHROCYTE LIFE SPAN IN THE CAT. W. N. Valentine, M. L. Pearce, Richard F. Riley, Esther Richter, and John S. Lawrence. May 1, 1951. 8p. (UCLA-131)

The mean life span of the erythrocyte in the cat, as determined by labeling heme with $N^{15}$, is 77 days. (auth)

3859

Atomic Energy Project, Univ. of California, Los Angeles
PULMONARY DISTRIBUTION OF RADIOACTIVE PARTICLES IN RABBITS AFTER INHALATION AND INTRAVENOUS INJECTION. George V. Taplin, James S. Grevior, Mary Louise Gautschi, Camille Finnegan, and Arthur Dunn. Apr. 25, 1951. 19p. (UCLA-132)

Inhalation studies in rabbits using particles of uniform size distribution ($P^{32}$-tagged B. subtilis spores) indicate that insoluble fine particles (0.5 to 1.5 $\mu$) are deposited evenly through the lobes of the lung and in higher concentration in the trachea immediately after a single 30-min inhalation exposure. Also it has been shown that the trachea and presumably the bronchi are cleared within 1 to 2 hr, whereas the lung parenchyma retains a significant amount of the bacterial spores initially deposited for at least 72 hr. Therefore, a single short inhalation exposure to insoluble radioactive particles about 1 $\mu$ in size may be hazardous. However, the efficient respiratory tract clearance mechanisms provide important physiological safety factors. (auth)

3860

THE BLOOD VOLUME AND BLOOD TURNOVER IN THORACIC SURGERY AS DETERMINED BY $P^{32}$ LABELLED RED BLOOD CELLS. Nathaniel I. Berlin, Donald F. Rowles, Grace M. Hyde, Robert J. Parsons, Paul C. Samson, and Shirley Port. Surg. Gynecol. Obstet. 92, 712-16(1951) June.

The changes in the blood volume and the blood-volume loss in 27 patients undergoing thoracic surgery are presented. The magnitude of blood loss or volume turnover is demonstrated in thoracic surgery. There is an average of about 1000-cc turnover in a thoracoplasty. The loss of blood is even greater in pneumonectomies and lobectomies. The volume of red blood cell loss is relatively higher than the amount of apparent plasma loss as determined in these cases. The clinical value of blood volume studies in thoracic surgical patients is presented. 24 references. (auth)

3861

BLOOD VOLUME OF THE NORMAL FEMALE AS DETERMINED WITH $P^{32}$ LABELED RED BLOOD CELLS. Nathaniel I. Berlin, Grace M. Hyde, Robert J. Parsons, John H. Lawrence, and Shirley Port. Proc. Soc. Exptl. Biol. Med. 76, 831-2(1951) Apr.

As measured in 16 normal human females with $P^{32}$-labeled red blood cells, the blood volume was 64.4 cc/kg, total red cell volume was 27.0 cc/kg, and the plasma volume was 37.0 cc/kg body weight. These values for the total red cell volume do not differ markedly from those observed in a similar group of males when the difference in total body fat in the two sexes is taken into consideration. (auth)

3862

DISTRIBUTION OF INTRAVENOUSLY INJECTED COLLOIDAL RADIOACTIVE IRON IN IRON PROTEINS OF THE NORMAL RABBIT AND OF RABBITS WITH TURPENTINE ABSCESS AND DIPHTHERIA TOXICOSIS. Ignazio Indovina. Am. J. Physiol. 165, 348-51(1951) May 1.

Intravenously injected bivalent colloidal iron ($Fe^{55}$ and $Fe^{59}$) is found in all the Fe-containing proteins of the rabbits. The ratio cpm/$\gamma$ of Fe is increased more in the ferritin and in the cytochromes than in the other compounds. In the turpentine abscess and diphtheria toxicosis the Fe goes especially into the liver (where the preformed apoferritin is resident), and the radioactivity in the myoglobin and in the cytochromes is low. No alterations were noted in the formation of hemoglobin. (auth)

3863

THE EFFECT OF HYPOPHYSECTOMY ON THE BIOLOGIC DECAY OF THYROIDAL RADIOIODINE. Raymond V. Randall, Nona Lorenz, and A. Albert. Endocrinology 48, 339-40(1951) Mar. (Note)

The biologic decay of thyroidal tracer $I^{131}$ was reduced to 13% of normal in male rats of the Sprague-Dawley strain during the first 16 days following hypophysectomy.

3864

THE EFFECTS OF HYPOPHYSECTOMY AND OF GROWTH HORMONE ON THE UPTAKE OF RADIOACTIVE PHOSPHORUS BY TISSUES. Irving I. Geschwind, Choh Hao Li, and Herbert M. Evans. Arch. Biochem. Biophys. 31, 168-82(1951) Apr.

Normal and hypophysectomized animals, fed ad lib., both with and without growth hormone treatment, were injected with 4 $\mu$c of $P^{32}$/100 g body weight and then were autopsied at varying time intervals following the injection. The effects of hypophysectomy and of growth hormone therapy on

$P^{32}$ uptake in plasma, liver, kidney, thymus, muscle, and tibia were also studied. In general, hypophysectomy resulted in increased uptake in the first 4 and decreased uptake in the last 2. Growth hormone tends to counteract, at least partially, the effects of hypophysectomy.

3865

THE EFFECT OF HYPOPHYSECTOMY ON THE UPTAKE OF RADIOACTIVE IODINE BY THE THYROID OF THE RAT. Raymond V. Randall and A. Albert. Endocrinology 48, 327-33(1951) Mar.

The effect of hypophysectomy on the thyroidal collection of radioiodine was determined by an in vivo method following injection of 1.0 $\mu$c of $I^{131}$. Following hypophysectomy, the rat thyroid collects about 12% as much I as before hypophysectomy. The defective collection of I occurs soon after operation and becomes maximal between 5 and 6 days after operation. (auth)

3866

HISTO-AUTORADIOGRAPHIC DETERMINATIONS OF RADIOACTIVE SUBSTANCES IN THE BODY. A STUDY ON EXPERIMENTALLY-INTRODUCED URANIUM. Adolfo Brusa. Boll. soc. ital. biol. sper. 26, 673-5(1950) Apr.-May. (In Italian)

Nonlethal doses of uranyl acetate were injected subcutaneously in guinea pigs, and sections from various organs were examined autoradiographically 1 to 6 days following the injection. The principal concentrations of U occur in the kidneys, being localized there in the cortical substance. In other organs the following main localizations are observed: the extreme portions of the bronchial ramifications of the lungs, the mucosa of the intestine, and the parenchyma of the lobuli of the liver.

3867

INCORPORATION OF $^{14}C$ LABELED GLYCINE INTO YEAST PROTEIN. Arthur H. Webb, Felix Friedberg, and Lawrence M. Marshall. Biochim. et Biophys. Acta 6, 568-71(1951).

Torula utilis incorporates $C^{14}$ into its protein fractions by an enzymatic process. The ratio of this uptake is influenced by time, temperature, pH, and disinfectants. This enzymatic uptake might be an expression of protein synthesis operating as an exchange reaction. (auth)

3868

INSULIN AND ADRENOCORTICOTROPIN LABELED WITH RADIO-IODINE. J. W. Ferrebee, B. B. Johnson, J. C. Mithoefer, and J. W. Gardella. Endocrinology 48, 277-83 (1951) Mar.

The methods used for iodination with $I^{131}$ of insulin and ACTH and for bioassay in rabbits, rats, and mice of the labeled compounds are described. No loss of hormonal activity was noted.

METABOLISM OF RADIOACTIVE VITAMIN $B_{12}$ BY THE RAT. Kendall W. Barbee and B. Connor Johnson. Proc. Soc. Exptl. Biol. Med. 76, 720-1(1951) Apr.

Radioactive $Co^{60}$-labeled vitamin $B_{12}$ has been given orally or subcutaneously to four adult white rats. The entirely $B_{12}$ radioactivity was excreted primarily in the urine following injection, while the $B_{12}$ + inorganic Co radioactivity was excreted primarily in the feces following oral administration. (auth)

3870

PENTADECANOIC ACID-5-$C^{14}$: ITS ABSORPTION AND LYMPHATIC TRANSPORT. I. L. Chaikoff, B. Bloom, B. P. Stevens, W. O. Reinhardt, and W. G. Dauben. J. Biol. Chem. 190, 431-5(1951) May.

Pentadecanoic acid-5-$C^{14}$ dissolved in corn oil was fed to rats into whose thoracic ducts the cannula had been introduced. Lymph was collected while the animals were unanesthetized. From 78 to 90% of the administered $C^{14}$ was absorbed. From 84 to 93% of the absorbed $C^{14}$ was recovered in lymph as $C^{14}$-labeled fatty acids. Methyl esters of the lymph fatty acids were prepared and fractionated by amplified distillation. From 86 to 101% of the $C^{14}$-fatty acids was identified as 15-carbon fatty acids. The conclusion is drawn that the transport of long-chain fatty acids, regardless of whether they contain an even or odd number of carbons, is a concern almost exclusively of the lymph, and that the length of long-chain fatty acids is apparently not modified during their transport from intestinal lumen to lacteal. (auth)

3871

RADIOCALCIUM AS AN INDICATOR IN THE STUDY OF THE ACTION OF ESTRADIOL ON CALCIUM METABOLISM. J. Govaerts, M. J. Dallemagne, and J. Melon. Endocrinology 48, 442-52(1951) Apr.

The influence of estrogen on Ca metabolism in soft tissues and skeleton has been studied in pigeons by the use of $Ca^{45}$. Daily estrogen injections produce an increase of Ca metabolism to a higher degree than can be observed to occur by normal hormonal secretion. The excretion of Ca is decreased by estrogen injections and at the same time the over-all retention of Ca is increased, yielding a biological half life of Ca of about 75 days instead of the 45 days in the controls. The distribution of Ca in bone was also studied by the radioautographic technique.

3872

RADIOIODINE CONCENTRATIONS AND CLEARANCES IN RATS RECEIVING IODINE, THYROID, AND PROPYLTHIOURACIL. Joseph B. Boatman and Campbell Moses. Endocrinology 48, 413-22(1951) Apr.

Muscle clearance of $I^{131}$ showed a significant depression in rats maintained for 120 days on propylthiouracil. Muscle

clearance in rats treated with stable iodine or with desiccated thyroid was within the normal range compared with control animals. $I^{131}$ content of whole blood, and especially of erythrocytes, was increased by both iodine and thyroid feeding. The effects of iodine, propylthiouracil, and desiccated thyroid on $I^{131}$ concentration ratios in thyroid gland, liver, adrenals, and pituitary were also investigated, as was the change in percentage of body weight of each of these organs.

3873

SOME FACTORS THAT INFLUENCE THE RELEASE OF IODINE FROM THE THYROID GLAND. J. Wolff. Endocrinology 48, 284-97(1951) Mar.

Variations in the release of $I^{131}$ from the thyroid gland have been determined by means of external $\gamma$ counting in rats subjected to a number of experimental conditions. Control (untreated) rats lost $I^{131}$ from the thyroid with a biological half life of 3.3 days. Addition of 0.03% propylthiouracil to the diet accelerated release to a half life of 1.6 days. Hypophysectomy resulted in a prolongation of the half life to about 24 days. Subsequent treatment of these animals with thyrotropin led to a rapid recovery of the release to normal or greater than normal values in 24 hr. Treatment with 15 $\mu$g of thyroxine daily had an effect similar to hypophysectomy. Thyrotropin treatment markedly accelerated the release of $I^{131}$ from thyroid. Large doses of iodide failed to influence the release of previously injected $I^{131}$ from the gland. Some limitations of this type of measurement are discussed.

3874

STUDIES ON THE CONVERSION OF 3-HYDROXYANTHRANILIC ACID TO NIACIN IN NEUROSPORA. Charles Yanofsky and David M. Bonner. J. Biol. Chem. 190, 211-18 (1951) May.

Resting mycelium of a mutant strain of Neurospora fungus, characterized by its ability to utilize niacin or its precursors for growth, converts kynurenine, 3-hydroxyanthranilic acid, or quinolinic acid to niacin. Resting mycelium of a second strain, characterized by a growth requirement for niacin and inability to utilize any niacin precursor, converts kynurenine or 3-hydroxyanthranilic acid to quinolinic acid and not to niacin. $N^{15}$-tracer experiments have shown that the N of the amino group of 3-hydroxyanthranilic acid is the sole precursor of the pyridine N of niacin in Neurospora. (auth)

3875

THE USE OF RADIOISOTOPES OF COPPER AND MOLYBDENUM IN NUTRITIONAL STUDIES. C. L. Comar. In Copper Metabolism; A Symposium On Animal, Plant, and Soil Relationships. Wm. McElroy and D. Glass, eds. Baltimore, The Johns Hopkins Press, 1950. p.191-215.

After a discussion of availability of isotopes, methods of measuring radioactivity, and preparation of samples for solution measurement, the author gives a detailed summary of previously reported nutritional studies using $Cu^{64}$ and $Mo^{99}$ which have been performed by himself and others on animals. An over-all picture has been obtained of the behavior of Cu in the animal body. The high points are the poor absorption of ingested Cu, the entrance of Cu into the hematopoietic centers, the liver storage of this element, the nature of the equilibrium between red blood cell and plasma Cu, the mucosal accumulation of Cu, and the increased liver storage of Cu by very young individuals. Through the use of $Cu^{64}$, $Mo^{99}$, and $P^{32}$ the physiological interrelationships of these elements have been studied; certain possible mechanisms have been ruled out and others are suggested.

3876

UTILIZATION OF INTRAVENOUSLY INJECTED RADIOACTIVE COLLOIDAL IRON IN RABBITS WITH MYOPATHY OF VITAMIN E DEFICIENCY. Ignazio Indovina. Am. J. Physiol. 165, 352-5(1951) May.

In experimental rabbit myopathy there is an increase in synthesis of myoglobin with diminution of its content. This means an increase of catabolism. For the cytochromes and hemoglobin the alterations are considered as secondary. Vitamin E normalizes the metabolism of myoglobin. There is an increase in the formation of hemoglobin. $Fe^{55}$ and $Fe^{59}$ were used in this study. (auth)

# CHEMISTRY

3877

North Carolina Univ.
THERMAL DECOMPOSITIONS OF ADDITION COMPOUNDS OF ZIRCONIUM TETRACHLORIDE AND HAFNIUM TETRACHLORIDE WITH ESTERS. W. S. Hummers, S. Y. Tyree, Jr., and S. Yolles. [nd] 2p. (AECU-1293)

The report is reproduced here in its entirety.

A study of the thermal decomposition of metal halide-ester addition compounds was made with the purpose of (1) finding a difference in the rate of decomposition of Hf and Zr compounds and (2) delineating the mechanism of the reaction. Indications are that pure Hf addition compounds decompose at a somewhat slower rate than the corresponding Zr compounds. This suggests that a separation of Hf and Zr might be feasible. Since the residue of the thermal decomposition of either a pure Zr or pure Hf addition compound is water insoluble and untreated addition compound reacts with water solubilizing the metal moiety, the means for accomplishing the separation is at hand. The thermal decomposition of $MeCl_4.2C_2H_5OOCC_6H_5$ is carried out as follows. About 2.5 g of the compound is weighed into a glass thimble about 3 to 4 in. deep and about 1 in. in diameter. This thimble is then thermostated at the desired temperature while connected to an all-glass system of 1.2-liter capacity. The

entire system is evacuated prior to a decomposition run; thus the increase in pressure within this system (measured by means of the Booth-Cromer diaphragm pressure transmitter) due to volatile decomposition products is a measure of the rate of the decomposition. Sufficient data are available at the conclusion of a run to determine the molecular weight of the principal volatile product. Samples of 20 to 25 g of addition compounds were destructively distilled (150 to 300°C) in order to obtain larger amounts of products for identification and analysis. The volatile products from such a decomposition were ethyl chloride (80% of theory), benzoyl chloride, ethyl benzoate, and a small amount of HCl. From the foregoing studies and analyses of the residue at least two mechanisms of the decomposition can be proposed. (1) A reaction which gives mainly ethyl chloride and simple compounds: (a) $MeCl_4.2C_2H_5OOCC_6H_5 \rightarrow MeCl_2(C_6H_5COO)_2 + 2C_2H_5Cl$ with possibly some side reaction such as: (b) $MeCl_4.MeCl_4.2C_2H_5OOCC_6H_5 \rightarrow Me(OC_2H_5)_2Cl_2 + 2C_6H_5COCl$; (2) a reaction which continues beyond (a) to give polymers: $2MeCl_2(OOCC_6H_5)_2 \rightarrow C_6H_5COCl + Cl_2(OOCC_6H_5)Me-O-MeCl(OOCC_6H_5)_2$ → possible further polymerization.

3878

North Carolina Univ.
COMPOUNDS OF ZIRCONIUM TETRACHLORIDE AND HAFNIUM TETRACHLORIDE WITH ESTERS; $MeCl_4 + C_6H_5COOC_2H_5 \rightarrow MeCl_4.2C_2H_4COOC_2H_5$. W. S. Hummers, S. Y. Tyree, Jr., and S. Yolles. [nd] 2p. (AECU-1302)

The report is reproduced here in its entirety.

Addition compounds of $ZrCl_4$ and $HfCl_4$ with esters such as ethyl benzoate, methyl benzoate, ethyl trifluoroacetate, and phenyl benzoate have been prepared. The reaction between metal halide and ester is most conveniently carried out in liquid $SO_2$. Other solvents and techniques have also been used, e.g.: direct union using an excess of ester, anhydrous ether, cyclohexane, or benzene. The reaction between ethyl acetate and metal halide is violent even at low temperatures and fails to yield insoluble addition compounds. This failure has been attributed (by an early investigator) to hydrogens $\alpha$ to the carbonyl group. The addition compounds are white, crystalline solids which decompose in water liberating the ester and dissolving the metal halide. On heating, decomposition rather than sharp melting takes place. A series of heat measurements for the reaction $ZrCl_4 + C_6H_5COOC_2H_5$ indicate that the 2:1 compound is the only one formed at ordinary temperatures.
Molecular weight determinations in nitrobenzene by the freezing point method and analyses further substantiate the formulas of the compounds.

Table 1 — (Direct addition)

| $ZrCl_4 : C_6H_5OOCC_2H_5$ | Kcal/mole of $ZrCl_4$ |
|---|---|
| 1:2 | 26.1 (estimated) |
| 1:4 | 25.2 |
| 1:6 | 23.0 |
| 1:8 | 22.8 |
| 1:10 | 24.9 |

Table 2 — (In nitrobenzene)

| $ZrCl_4 : C_6H_5OOCC_2H_5$ | Heat effect kcal/mole $ZrCl_4$ | Molar heat of solutions of $ZrCl_4$ in nitrobenzene | Total heat of reaction kcal/mole $ZrCl_4$ |
|---|---|---|---|
| 1:1 | 7.0 | 10.4 | 17.4 |
| 1:2 | 10.8 | 10.4 | 21.2 |
| 1:4 | 10.6 | 10.4 | 21.0 |
| 1:6 | 10.6 | 10.4 | 21.0 |
| 1:8 | 10.5 | 10.4 | 20.9 |
| 1:10 | 10.5 | 10.4 | 20.9 |

3879

Pupin Physics Lab., Columbia Univ.
THE COUPLING OF BENZENE DIAZONIUM CHLORIDE WITH PHENOL ALCOHOLS. E. Marder and I. W. Ruderman. Dec. 13, 1950. 6p. (CUD-62; DR-1567)

2-Hydroxy-$\alpha^1$-mesitylenol (I), 4-hydroxy-$\alpha^1$-mesitylenol (II), and 2-hydroxy-$\alpha^1$, $\alpha^3$-mesitylenediol (III) have been found to couple with benzene diazonium chloride in alkaline solution, although these phenols contain no open positions ortho or para to the phenolic hydroxyl group. The azo dyes, which were thus formed from these phenol alcohols in good yields (50 to 100%) were isolated, purified, analyzed, and compared with the dyes obtained from the corresponding phenols containing no hydroxymethyl groups. Absorption data in the 2800 to 5000 A region were obtained for dilute benzene solutions of each product. The dyes obtained from I and from 2,4-dimethylphenol were found to be identical, as were those from II and 2,6-dimethylphenol. The dye from III differs from that obtained from p-cresol in that the former still contains a single ortho hydroxymethyl group. It is concluded that coupling takes place at the hydroxymethyl position, with the elimination of the hydroxymethyl group as formaldehyde. (auth)

3880

Columbia Univ.
RADIOCHEMICAL LABORATORIES, sect.IV of PROGRESS REPORT; [SECOND QUARTERLY PROGRESS REPORT FOR FISCAL YEAR 1950-1951]; NUCLEAR PHYSICS LABORATORIES. J. R. Dunning, Director. Dec. 31, 1950. 2p. (CUD-65(sect.IV); BR-1578)

The following $\beta$-ray sources were prepared: $Tc^{99}$, $Na^{24}$, $K^{42}$, $Cu^{64}$, $Na^{22}$, $Br^{80}$, $Nb^{95}$, $Cl^{36}$. A pure sample of tri-o-phenylene diborate has been prepared for study as a liquid neutron detector. Diphenyl telluride has been prepared. A method has been developed for plating a uniform, adherent deposit of $Te^{124}$ on thin Pt foil. Plastic phosphor studies indicate that polystyrene containing 1% p-terphenyl produces much smaller pulses than those of 1% terphenyl in xylene. Fabrication of cast $B_2O_3$ transmission samples has been started. The procedure, similar to that used in making the $B_2O_3$ scattering target, should produce a uniform, pure sample. No appreciable data on these operations are available in this report.

3881

THE GERMANES AND THEIR ORGANO DERIVATIVES. Otto H. Johnson. Chem. Revs. 48, 259-97(1951) Apr.

The methods of preparation and the properties of all known organogermanium compounds, and also many germanium compounds that are not strictly organic compounds but are prepared by organic procedures, are summarized. Many of the physical constants of these compounds are given in

tables. The survey is complete to January 1950. 99 references.

3882

ISOTOPE EFFECT ON DISSOCIATION PROBABILITIES IN THE MASS SPECTRA OF CHLOROFORM AND CHLOROFORM-d. Vernon H. Dibeler and R. B. Bernstein. J. Chem. Phys. 19, 404-6(1951) Apr.

The mass spectra of the isotopic molecules $CHCl_3$ and $CDCl_3$ have been determined, using electron energies of 50 and 70 volts. It was found that the probability of dissociation of the C−H bond is approximately three times that for the dissociation of the C−D bond. The relative probability of dissociating H + Cl and D + Cl is the same as the relative probability of obtaining $HCl^+$ and $DCl^+$ ions, namely, about 1.6. Equal probability was observed for the dissociation of H + 2Cl and D + 2Cl. The probability of removing Cl atoms is only slightly affected by the D substitution. (auth)

3883

THE SOLUBILITY OF $MgF_2$ IN SOLID LiF. Y. Haven. Rec. trav. chim. 69, 1505-18(1950) Dec.

From work on the ionic conductivity of $LiF-MgF_2$ mixed crystals the solubility of $MgF_2$ in solid LiF has been derived at temperatures from 400 to 700°C. The solubility is of the order of magnitude of several per cent. The rules given by Goldschmidt for the miscibility of ionic substances have been extended. Apart from the similarity in ionic radius which was emphasized by Goldschmidt, the gain in polarization energy upon solution of the solute also has to be considered. This polarization energy is particularly important in cases where the solute contains ions with a valency different from that of the solvent ions. (auth)

3884

SURFACE TENSION OF MOLTEN ALKALI SILICATES. Leo Shartsis and Sam Spinner. J. Research Natl. Bur. Standards 46, 385-90(1951) May.

The surface tensions of a series of Li, Na, and K silicate melts were measured by a maximum-pull-on-cylinder method. The order Li > Na > K was established for surface tension as well as for the algebraic value of the temperature coefficient of surface tension. Lithia and soda raised the surface tension, and potash lowered it. The surface tension curves of different alkali content converged with increasing temperature for Li and Na, but diverged for K silicates. Liquids containing less than 33 mole % of lithia had positive temperature coefficients of surface tension. Correlation was observed between alkali content, volume expansivity, and temperature coefficient of surface tension. (auth)

3885

THE SYSTEM; THORIUM NITRATE-ETHER-WATER BETWEEN 0° AND 20°; trans. from Gazz. chim. ital. 60, 833-8(1930). P. Misciatelli. 1930. 8p. (NP-2295)

The text of the original article has been translated, but footnotes and illustrations have been omitted. The methods used in studying the ternary system $Th(NO_3)_4 - (C_2H_5)_2O - H_2O$ from 0 to 20°C are detailed, and the phase diagram is discussed briefly.

ANALYTICAL PROCEDURES

3886

Pennsylvania State Coll.
POLAROGRAPHIC BEHAVIOUR OF ORGANIC COMPOUNDS; VII. IODOACETIC ACID AND THE BROMOACETIC ACIDS. (Report No. 2). Philip J. Elving, Isadore Rosenthal, and Marilyn Koll Kramer. Aug. 9, 1950. 17p. (NYO-643)

In the pH range 1 to 12 iodoacetic acid gives one polarographic wave, whereas tribromoacetic acid gives three, the most negative of which is identical in characteristics with the one wave of monobromoacetic acid and the more negative of the two waves of dibromoacetic acid. The intermediate tribromoacetate wave is identical in behavior with the more positive dibromoacetate wave. Each wave is irreversible with the possible exception of the most positive tribromoacetate wave. Each wave represents a two-electron current-producing process, which is due to the fission of a carbon-halogen bond. The mechanism of reduction is the step-by-step removal of halogen, e.g., tribromoacetic going to dibromoacetic and then to bromoacetic. There is an S-shaped relation between $E_{0.5}$ and pH with the rising portion of the relation including the region of the $pK_a$ of the acid; the $E_{0.5}$ becomes more negative with increasing pH and may be pH-independent in portions of the acidic and basic regions. (auth)

3887

Pennsylvania State Coll.
THERMOSTATED H-CELL FOR POLAROGRAPHY. (Report No. 4). Joseph C. Komyathy, Francis Malloy, and Philip J. Elving. Nov. 10, 1950, 5p. (NYO-796)

An improved type of H-type cell is described which is especially adapted for polarographic study using a saturated calomel reference electrode. The entire cell has been jacketed to permit convenient and adequate temperature control. (auth)

3888

AMPEROMETRIC TITRATIONS WITH m-NITROPHENYLARSONIC ACID. I. M. Kolthoff and Ralph A. Johnson. J. Electrochem. Soc. 98, 138-45(1951) Apr.

In connection with the amperometric titrations of metal ions with arsonic acids, the polarography of certain arsonic acids has been studied. The arsonic acids are reduced to substituted arsines in a six-electron reduction. The nitro group of m-nitrophenylarsonic acid is reduced in two steps: (a) nitro to hydroxylamine involving four electrons and (b) hydroxylamine to amine involving two electrons. The effect of HCl concentration on these reductions is discussed. m-Nitrophenylarsonic acid ($H_2R$) is a suitable reagent for the amperometric titrations of uranyl, Th, Zr, and stannic Sn. The compositions of the precipitates at the end point are $UO_2R$, $ThR_2$, $ZrR_2$, and SnR, respectively. Zr first precipitates as the monoarsonate which is readily transformed into the diarsonate by excess reagent. SnR reacts

slowly with an excess of reagent to form $SnR_{1.5}$. Qualitatively, Ti(IV) behaves like Sn(IV), but an amperometric titration of Ti is not feasible. Th reacts directly to form the diarsonate. The amperometric titrations described permit direct determination of $UO_2$, Th, Zr, and Sn(IV). (auth)

3889

ELECTROLYTIC INVESTIGATIONS. V. ELECTROLYTIC DETERMINATION OF BISMUTH. George Norwitz. Anal. Chim. Acta 5, 195-6(1951) Apr.

An accurate method is proposed for the electrolytic determination of Bi. The electrolysis is conducted from a nitric acid medium. It is essential that the residual nitrous acid left in the solution after dissolving the sample with nitric acid be destroyed by boiling with hydrogen peroxide, and that the electrolysis be conducted in the presence of a trace of hydrochloric acid. (auth)

3890

PREPARATION OF BARIUM CARBONATE FOR ASSAY OF RADIOACTIVE CARBON-14. R. B. Regier. Philips Petroleum Company Research Department Report No. 723-48R, 1949.

The effect of crystal size upon the nature of the deposit which is formed when $BaCO_3$ is mounted on disks for measurement of its radioactivity has been investigated. It was found that the best specimens are prepared from $BaCO_3$ precipitated under conditions which cause slow crystal growth and produce large crystals. These conditions include using dilute reagents, elevated temperature, and lowered alkalinity. (auth)

3891

SEPARATION OF Zr IN THE FORM OF AN ARSENATE FROM Fe, Al, Th, and Ce. I. Surudi (von Stetina). Z. anal. Chem. 131, 416-23(1950). (In German)

A detailed study was made of the method due to Moser et al. (Monatsh. 45, 323(1924); see also Z. anal. Chem. 92, 440(1933)) for the separation of Zr from Fe, Al, Th, and Ce. Zr was precipitated with sodium arsenate from a $HNO_3$ solution at boiling temperature mainly as $ZrO.HAsO_4$ but partly as $Zr_3(AsO_4)_4$; owing to the uncertainty of its composition the precipitate was transformed into the weighable form $ZrO_2$ through several procedures ending in calcination. The optimal concentration of the $HNO_3$ solution was established, and certain modifications were made in the original process of obtaining $ZrO_2$. It is pointed out that when only a small amount of $Zr_3(AsO_4)_4$ is present in the precipitate (this is the case when only a small excess of sodium arsenate is used) the precipitate can be calcined into $(ZrO)_2As_2O_7$, also a readily weighable compound.

3892

Geological Survey
A STUDY OF CRITICAL FACTORS IN THE "DIRECT" FLUORIMETRIC DETERMINATION OF URANIUM. Mary H. Fletcher. Oct. 1950. 33p. (TEI-130)

A study was made of the important factors in the "direct" fluorimetric determination of U in the range 0.0005 to 0.08 μg of U, and a modified procedure based on these results is given. Detailed time-temperature studies showed that the sensitivity of the fluorescent method decreased rapidly when the fusion temperature was greater than 650°C and that, at temperatures above 650°C the sensitivity decreased with increased time of heating. Inhomogeneity of the carbonate fluoride flux led to erratic results. Highly reproducible results were obtained by fusing at 650°C for 25 min, using a carbonate fluoride flux that had been fused and then ground. Phosphors prepared by this procedure are reproducible to about 5% day after day, thus allowing the use of a permanent standard curve. Standard samples are unnecessary once the standard curve has been prepared. (auth)

## CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

3893

Ames Lab.
THE HYDROGEN POSITIONS IN URANIUM HYDRIDE BY NEUTRON DIFFRACTION. (Contribution No. 73). R. E. Rundle. [nd] Decl. Mar. 28, 1951. 12p. (AECD-3111)

The D positions in $UD_3$ have been determined by neutron diffraction, and show that the bridge structure previously proposed for $UH_3$ is incorrect. The D's lie in distorted tetrahedra, equidistant from 4 U atoms, with U−D = 2.32 A. There are two types of U atoms in the structure, each with 12 nearest D atoms at this distance. The structure is illustrated. 7 references. (auth)

3894

Argonne National Lab.
THE CRYSTAL STRUCTURE OF PLUTONIUM SESQUICARBIDE. W. H. Zachariasen. Feb. 13, 1951. 10p. (AECD-3146; ANL-FWHZ-186)

The crystal structure of $Pu_2Cl_3$ is described in some detail. $Pu_2C_3$ is found to be cubic with 8 molecules per unit cell and a unit cell constant a = 8.129 ± 0.001 A. The calculated density is 12.70. The space group is $I\bar{4}3d(T_d^6)$. The Pu atoms are in 16-fold positions with the parameter x = 0.050 ± 0.003. A reasonable structure is obtained with the C atoms in 24-fold positions with the parameter y = 0.280. Each Pu atom is bonded to 9 C atoms, 3 being at a distance of 2.48 A, 3 at 2.51 A, and 3 at 2.84 A. The shortest Pu−Pu distance is 3.35 A. The C atoms are bonded together by covalent bonds to form $C_2$ groups. (auth)

3895

Ames Lab. and Oak Ridge National Lab.
THE CRYSTAL STRUCTURE OF THORIUM AND ZIRCONIUM DIHYDRIDES BY X-RAY AND NEUTRON DIFFRACTION. R. E. Rundle, C. G. Shull, and E. O. Wollan. Apr. 20, 1951. 16p. (AECU-1275)

Thorium forms a tetragonal lower hydride of composition $ThH_2$. The hydrides $ThH_2$, $ThD_2$, and $ZrD_2$ have been studied by neutron diffraction in order that hydrogen positions

could be determined. The hydrides are isomorphous, and have a deformed fluorite structure. Metal–hydrogen distances in $ThH_2$ are unusually large, as in $UH_3$. Th and Zr scattering amplitudes and a revised scattering amplitude for D are reported. (auth)

3896

Cornell Univ.
PROGRESS REPORT; STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS.
J. L. Hoard. Apr. 1, 1951. 4p. (NYO-717)

Brief statements are made on the status of various phases of this program. A brief account of the approximate structure found for tetragonal B can be found in NYO-890. A somewhat more comprehensive description is contained in reports NYO-715 (NSA 5-2422) and NYO-716. Results of the determination of the structure for B-trichloroborazole are presented in NYO-718.

3897

ON THE THEORY OF IONIC CONDUCTIVITY IN CRYSTALS.
Y. Haven. Rec. trav. chim. 69, 1259-74(1950) Sept.-Oct.

A survey is given of the existing theories of the ionic conductivity in crystals. The experimental log $\kappa - 1/T$ curves usually consist of two straight parts with different slopes. This shape can be explained by several mechanisms. For the conductivity of mixed crystals, where the solute introduces additional vacancies, a formula is derived which gives the conductivity as a function of the concentration of the solute and of the temperature. A method has been given which makes it possible to choose between the explanations for the kink in the conductivity curve in a given case. It is based on an analysis of the transition region between the two straight parts of the curves, and was applied to the conductivity of Li halides and $LiX-MgX_2$ mixed crystals. It was found that in this case the kink in the conductivity curves could be described by the derived formula, but not by the mechanisms proposed by others. (auth)

3898

THE STRUCTURE OF THE FERROELECTRIC NIOBATES AND TANTALATES. P. Vousden. Acta Cryst. 4, Part 1, 68(1951) Jan. (Short communication)

The article is reproduced here in its entirety.

The symmetries and parameters of the recently reported ferroelectric materials $KTaO_3$, $KNbO_3$, $NaTaO_3$, $NaNbO_3$ (Matthias, Phys. Rev. 75, 1771(1949)) have been measured by x-ray powder methods. At room temperature $KTaO_3$ is cubic and the other compounds are orthorhombic in symmetry. $NaNbO_3$ and $KNbO_3$ have tetragonal and cubic phases at higher temperatures similar to $BaTiO_3$, but $NaNbO_3$ has no rhombohedral phase as low as $-173°C$. Untwinned crystals of $NaNbO_3$ have been investigated by single-crystal methods. The unit cell has dimensions $\simeq 5.6 \times 16 \times 5.6$ A and contains eight molecules. The space group is $P22_12$, and the structure has 26 parameters, most of which have been determined. The results show a displacement of the Nb ions by ~0.1 A along the long orthorhombic axis. The space group conclusively shows the structure to be nonpolar unless the symmetry is really monoclinic (cf. Rochelle salt). However, optical and x-ray measurements have shown that any shear of the faces is $< 0.1'$, which is $<1/300$ of the orthorhombic distortion. The conclusion that orthorhombic $NaNbO_3$ is nonpolar is most unexpected but can thus hardly be avoided. A consistent explanation of the ion displacements can be given in terms of packing considerations along. It is supposed that the orthorhombic distortion caused by the ferroelectricity allows ion shifts which reduce the misfit caused by the small Na ion. It is this arrangement that can be shown to be nonpolar. A detailed account of these researches will be published later.

## FLUORINE AND FLUORINE COMPOUNDS

3899

Atomic Energy Project, Univ. of Rochester
FLUORIDE CONTENT OF PUBLIC WATER SUPPLIES, p.106-8 of QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. F. A. Smith and D. E. Gardner. Feb. 1, 1951. 3p. (UR-152(p.106-8)

An investigation of the determination of fluoride in strongly acid (pH~2) aqueous solutions indicated that the routine analytical procedure based upon ashing in the presence of lime, distilling from $HClO_4$, and titration with Th, gives recoveries of only approximately 80%. A series of water samples collected in acid medium, at the source and at the tap in ten U. S. cities showed fluoride concentrations ranging from 0.01 to 0.95 ppm fluoride. In general, no appreciable differences in fluoride concentration were noted between source and tap samples. (auth)

3900

THE ELECTROCHEMISTRY OF BORON TRIFLUORIDE CO-ORDINATION COMPOUNDS. PART I. BORON TRIFLUORIDE–ETHYL ETHER. N. N. Greenwood, R. L. Martin, and H. J. Emeléus. J. Chem. Soc., 3030-6(1950) Nov.

The specific electrical conductivity and kinematic viscosity of liquid boron trifluoride–ethyl ether, $BF_3.(C_2H_5)_2O$, have been investigated in the temperature range −10 to +45°C. At 25°C the conductivity is $2.97 \times 10^{-4}$ ohm$^{-1}$ cm$^{-1}$, and the viscosity is 1.71 centistokes. Electrolysis of the pure liquid results in liberation at the cathode of a mixture of hydrogen, ethane, and ethyl ether. No gas is evolved at the anode. The decomposition potential is temperature dependent and has the value 1.25 volts at 25°C. These measurements indicate that considerable ionic character is introduced into ethyl ether when coordinated to boron trifluoride. The nature of the ions present is discussed, and it is concluded that the compound is ethyl ethoxyfluoroborate, $C_2H_5.[BF_2.O.C_2H_5]$. (auth)

3901

THE REACTIONS OF FLUOROCARBON RADICALS. PART II. THE REACTION OF TRIFLUOROIODOMETHANE WITH ACETYLENE. R. N. Haszeldine. J. Chem. Soc., 3037-41(1950) Nov. (See also NSA 5-796)

The interaction of trifluoroiodomethane and acetylene under the influence of heat or of ultraviolet radiation yields 3,3,3-trifluoro-1-iodoprop-1-ene and probably higher members of the series $CF_3\cdot[CH=CH]_n\cdot I$. The oxidation of 3,3,3-trifluoro-1-iodopropene to trifluoroacetic acid provides an example of a general method for the synthesis of fluoro acids, $R\cdot CO_2H$, from the fluoroalkyl iodides, RI. The use of chlorine trifluoride to prepare iodine pentafluoride and bromine trifluoride is described. (auth)

3902

REACTIONS OF THE PERFLUOROALKYL RADICALS. J. Banus, H. J. Emeléus, and R. N. Haszeldine. J. Chem. Soc., 3041-5(1950) Nov.

The absorption spectra of trifluoroiodomethane and pentafluoroiodoethane are continuous in the near ultraviolet, and irradiation is believed to yield the trifluoromethyl and pentafluoroethyl radicals. The increase in the rate of photodecomposition of trifluoroiodomethane by the addition of oxygen, chlorine, cyanogen, or ethylene is attributed to the reaction of the added substance with one of the products of homolytic fission of the fluoroiodide. Semiquantitative observations on the quantum yields of certain of these reactions are recorded. The reactions of the $CF_3$ radical, produced thermally or photochemically, with ethyl alcohol, hexane, or water yields fluoroform, whereas chlorotrifluoromethane is formed by reaction with $CCl_4$. The mercurials $C_2F_5.HgX$ (X = F, Cl, Br, and OH) and $Hg(C_2F_5)_2$ have been synthesized. (auth)

## LABORATORIES AND EQUIPMENT

3903

Carbide and Carbon Chemicals Co., K-25
GAS TITRATIONS; AMMONIA AND HYDROGEN CHLORIDE. Sidney Katz. Apr. 27, 1951. 12p. (K-751)

An instrument for direct gas-with-gas titrations, using pressure measurements to determine titer and endpoint, has been developed. It is usable where a change in pressure is a result of the gas reaction. The application of such gas titrations to the reaction of $NH_3$ and HCl has been explored. (auth)

3904

Los Alamos Scientific Lab.
LOW EVAPORATION RATE STORAGE VESSEL FOR LIQUID HELIUM. S. G. Sydoriak and H. S. Sommers, Jr. Feb. 1, 1951. 25p. (LA-1200)

Expressions are derived for the heat flux $q_0$ and temperature gradient $dT/dh$ in a pyrex cylinder (a) in vacuum and (b) in the atmosphere of cold vapor issuing from a liquid-He container. In the temperature range $20 < T < 300$ it is found for case (a) that $q_0 \propto T^{1.8}$ and $dT/dh \propto T^{-0.8}$, whereas in case (b) $q_0 \propto T$ and $dT/dh$ is nearly constant. Design details and operating procedures are given for a 12-liter liquid-He storage vessel intended to complement the Collins He liquefier. It can be filled in 1 day's operation of the liquefier, and 10 days later is still half full. (auth)

3905

New York Operations Office and New York Univ.
REDESIGN OF A SANITARY ENGINEERING LABORATORY TO PERMIT THE USE OF RADIOISOTOPES. Paul B. Klevin and Werner N. Grune. Mar. 30, 1951. 13p. (NYO-1553)

The sanitary engineering laboratory, which had been carrying out research on problems of sewage, extended its work to include radioisotope investigation. $\beta$-emitting $P^{32}$ and $\gamma$-emitting $I^{131}$ were used in levels up to 10 mc. This report covers the investigation of various components and the design and cost of the necessary modifications to ensure adequate safeguard of experimental work and personnel. 8 figures. (auth)

3906

Oak Ridge National Lab.
EXPERIMENTAL JAR TEST LABORATORY STIRRING DEVICE. Conrad P. Straub and P. N. Hensley. May 14, 1951. 21p. (ORNL-965)

A 10-unit laboratory jar-test stirring device for determining optimum chemical dosage requirements has been designed and built. For speed control, a gear shift-controlled drive is provided, which will permit peripheral velocities of 2.83 fps (rapid mix) and 0.71 fps (slow mix). A description of the unit, drawings, material requirements, and estimated cost, excluding overhead, are included. (auth)

3907

Geological Survey
A BATTERY-POWERED FLUORIMETER FOR THE DETERMINATION OF URANIUM. Irving May and Mary H. Fletcher. Dec. 1950. 16p. (TEI-135)

A transmission fluorimeter for determining U by its fluorescence in fluoride melts is described which is completely battery-powered and which is suitable for use in the laboratory, in field stations, or in mobile units. The ultraviolet light source is a 3-watt RP-12 lamp. The instrument is sufficiently sensitive for the determination of 0.001% U in a 0.4-mg sample. (auth)

3908

Geological Survey
THE DESIGN OF THE MODEL V TRANSMISSION FLUORIMETER. Mary H. Fletcher, Irving May, and Joseph W. Anderson. Dec. 1950. 13p. (TEI-133)

A transmission fluorimeter for the measurement of the fluorescence of U in fluoride melts is described. The instrument incorporates several improved features which have not been published previously. Unlike the earliest models, the design of the new fluorimeter, with its close machining of parts, reduces the possibility of light leakage and also increases considerably the ease with which the various components of the instrument may be assembled and adjusted. It possesses great flexibility so that various phototubes, measuring devices, light sources, and filter combinations may be used interchangeably. Detailed shop drawings are given for the construction of the fluorimeter. (auth)

## RADIATION EFFECTS

3909

Notre Dame Univ.
DETECTION AND IDENTIFICATION OF FREE RADICALS FORMED IN THE RADIOLYSIS OF ALKANES AND ALKYL IODIDES. (thesis) Lewis H. Gevantman. Mar. 1, 1951. 49p. (AECU-1325)

A group of alkyl iodides in both liquid and vapor phase and a series of alkanes in gas phase were irradiated in the presence of $I_2$ containing $I^{131}$ with $\gamma$ rays, x rays, and high-energy electrons. Macroscopic quantities of alkyl iodide carriers were added to the products, and the resulting mixture was fractionated and counted to determine the relative yields of iodides produced. Variations in the relative yields of products were also measured as a function of changes in energy and intensity of radiation, iodine concentration, pressure, and temperature. The yields of iodides observed are identified with the relative yields of free radicals produced in radiolysis reactions, and a limited interpretation regarding their behavior in such reactions is discussed. Several experiments were also performed to establish the validity of the method. (auth)

3910

Notre Dame Univ.
SOME ELEMENTARY PHYSICAL AND CHEMICAL PROCESSES IN RADIOBIOLOGY. Milton Burton. [nd] 14p. (AECU-1328)

Simple observations of radiobiology, particularly relating to target theory, the effect of $O_2$, and inhibition of $O_2$ effects, are explicable in terms of elementary physical and chemical processes of radiation chemistry. The target is not identified with the biological entity. The latter and the ambient fluid are included in the target, but the biological entity is not uniformly sensitive. The sensitive volume of fluid is determined by the range of effective radicals produced therein. The free radicals H and CH are extremely active but, consequently, have a small diffusion range. Presence of $O_2$ causes entrapment of free H to give the less active, and therefore longer range, free radical $HO_2$. $O_2$ increases target size for, and therefore lethality of, x or $\gamma$ radiation but no $O_2$ effect is possible with heavy-particle bombardment within the ordinary range of $O_2$ pressures. Lethality of $O_2$ containing solutions may be decreased by introduction of protective agents, oxidizable by $HO_2$ but not by $O_2$. (auth)

3911

Notre Dame Univ.
ELEMENTARY PROCESSES IN THE RADIATION CHEMISTRY OF WATER AND IMPLICATIONS FOR RADIOBIOLOGY. Milton Burton. [nd] 22p. (AECU-1329)

The effect of radiation on a simple biological entity suspended in water is examined. Hits in the region surrounding the entity are effective via the action of free H atoms and OH radicals liberated in the ionization track of the impingent particle. The range of such chemically active intermediates is, however, very short so that the target size is not thereby greatly increased. Presence of dissolved $O_2$ causes production of $HO_2$ when local transient H atom concentrations permit (as in $\gamma$, x, or electron irradiation experiments), and the range of an effective hit is thereby increased. The biological entity may be protected against this $O_2$ effect by incorporation in the aqueous fluid of a solute which can react readily with $HO_2$ but not with $O_2$. The probability of lethality of a hit within the biological entity itself is reduced by existence of nonlabile regions, excitation transfer to such regions, and the Franck-Rabinowitch cage effect. These effects tend to make ratio of target size to actual size of the biological entity decrease with increasing size of the latter. A hit within the biological entity may act also indirectly by transmission of ionization to the water by ionization transfer and by electron capture. The H atoms and OH radicals therein liberated may then act on the biological entity if a chemically suitable surface of the entity is there presented. The possibility of such a process is increased when H and OH radicals are liberated in water inside the entity. It is suggested that incorporation of such anions as $Br^-$ or $I^-$ would increase the sensitivity to $\gamma$, x, or electron radiation of biological systems susceptible to $H_2O_2$. (auth)

3912

CHEMICAL ACTIONS OF IONISING RADIATIONS IN SOLUTION. PART IX. RADIATION CHEMISTRY OF STEROLS. THE ACTION OF X-RAYS ON (+)-ESTRONE-b IN AQUEOUS SOLUTIONS. Max Keller and Joseph Weiss. J. Chem. Soc., 1247-9(1951) May.

It is shown that the action of x rays on (+)-estrone-b in aqueous systems leads to formation of a lactone which is identical with that first prepared by Westerfeld (J. Biol. Chem. 143, 177(1942)). The mechanism of its formation by x rays suggests that the lactone ring is formed by a $CO_2H$ group involving $C_{(17)}$ and an OH group at $C_{(18)}$. Comparison of Westerfeld's lactone with the lactone prepared from estrone acetate by Jacobsen (J. Biol. Chem. 171, 61, 81(1949)) has shown that in the pure state they are identical. (auth)

3913

ROENTGEN IRRADIATION OF PARA-AMINOBENZOIC ACID SOLUTIONS. Peter G. Mar and Ivan C. C. Tchaperoff. Science 113, 549-51(1951) May 11.

An investigation has been made of the radiation chemistry of p-aminobenzoic acid (PABA) and its derivatives. Stock millimolar solutions of PABA were irradiated and immediately checked for the amount of PABA remaining in solution. The per cent unchanged is plotted against the time irradiated at four different dosage rates. PABA at dilutions approximating those usually found under physiological and therapeutic conditions in human tissues is destroyed by x irradiation in an exponential manner. The chemical change which takes place in the PABA molecule on irradiation has not been determined.

## SEPARATION PROCEDURES

3914

APPLICATION OF THERMAL DIFFUSION TO GAS ANALYSIS. E. Whalley. Trans. Faraday Soc. 47, 129-37(1951) Feb.

It should be possible to analyze three-component gas mixtures by partly separating with a thermal diffusion column and measuring the properties of the mixtures obtained. The minimum sizes and the minimum equilibrium time of a thermal diffusion column required for a given separation are discussed theoretically, and it is shown that these have quite practicable values. (auth)

3915

SEPARATION OF THORIUM FROM URANIUM. K. V. S. Krishnamurty and Bh. S. V. Raghava Rao. Rec. trav. chim. 70, 421-4(1951) May.

Anisic acid is a suitable reagent for the separation of Th from U. From neutral solutions Th is separated from twice its quantity of U in a single precipitation; when the ratio U/Th is >2 and <8, a second precipitation is required. (auth)

## SPECTROSCOPY

3916

ARC AND SPARK SPECTRA OF TECHNETIUM. William F. Meggers and Bourdon F. Scribner. J. Research Natl. Bur. Standards 45, 476-89(1950) Dec.

Solutions containing 50 to 200 μg of Tc were dried on Cu electrodes and excited by electric arcs or sparks. A stigmatic concave grating of 22-ft radius was employed to photograph the spectra from 2200 to 9000 A, within which limits more than 2300 lines characteristic of Tc atoms or ions were recorded. Wavelengths were measured relative to iron standards, relative intensities were estimated on a scale of 1 to 1000, and almost every line was definitely assigned either to neutral Tc atoms or to singly charged ($Tc^+$) ions. The measured wavelengths range from 2261.30 to 8829.80 A with average probable errors rarely exceeding ±0.01 A. The average results of wavelength measurements and of intensity estimates for 2121 lines in Tc I and Tc II spectra are presented. The strongest Tc I lines have wavelengths 4297.06, 4262.26, 4238.19, 4031.63, and 3636.10 A. The strongest Tc II lines have wavelengths 2543.24, 2610.00, and 2647.02 A. This description of Tc I and Tc II spectra will serve for spectrochemical identification and for structural analyses of these spectra. (auth)

3917

BAND SPECTRA OF CADMIUM HYDRIDE AND CADMIUM DEUTERIDE; COMPARISON OF THEIR FINE STRUCTURE WITH THAT OF OTHER DOUBLET SPECTRA. Erik Svensson. Thesis, University of Stockholm, 1935. (In German)

An experimental and theoretical study is presented of the spectra of CdH and CdD, the Cd-isotope effect being taken into consideration.

## SYNTHESES

3918

LABELLING OF PROTEINS WITH IODINE-131, SULPHUR-35, AND PHOSPHORUS-32. G. E. Francis, W. Mulligan, and A. Wormall. Nature 167, 748-51(1951) May 12.

The labeling of proteins with $I^{131}$ can readily be effected by iodination in weakly ammoniacal solution. In this way proteins can be "trace-labeled" without serious alteration in their chemical and physical properties, or more fully iodinated proteins can be prepared. Methods of preparation are discussed. Proteins labeled with $P^{32}$ prepared by treating the protein with phosphoryl chloride have a limited use for most biological investigations, but those labeled with $S^{35}$ (by the use of mustard gas sulfone) are very suitable, since the attached sulfone label is not readily removed in vivo. A brief account is given of double isotopic-labeling of proteins with $I^{131}$ and $S^{35}$. (auth)

3919

NOTE ON THE PREPARATION OF SODIUM RADIOCARBONATE. Pascaline Daudel and Roland Muxart. Bull. soc. chim. France, 274-5(1951) Mar.-Apr. (In French)

$Na_2C^*O_3$, which presents certain advantages over $BaC^*O_3$ for chemical manipulations with radioactive carbon, is six times as expensive as the barium salt, the cheapest available. A laboratory setup for the transformation of the latter into the sodium salt is described. (auth)

3920

PREPARATION OF $C^{14}$-CHOLESTEROL FROM $C^{14}$-CHOLESTENONE. Erwin Schwenk, Marcel Gut, and Joseph Belisle. Arch. Biochem. Biophys. 31, 456-7(1951) May. (Letter to the editor)

The best method for the preparation of $C^{14}$-cholesterol hitherto published consists in the reduction of the enol acetate of $\Delta^4$-cholesten-3-one with $LiAlH_4$ (Dauben, and Eastham, J. Am. Chem. Soc. 72, 2305(1950)). It has been found that a considerable increase in yield can be obtained when $NaBH_4$ is used as a hydrogen source in this reduction in the place of $LiAlH_4$. Experiments are described in which pure cholesterol was prepared in yields of 60% of the theory.

3921

Atomic Energy Research Establishment, Harwell, Berks. (England)
THE PREPARATION OF DIBORANE. F. Hudswell, J. S. Nairn, and K. L. Wilkinson. Jan. 1951. 12p. (AERE-C/R-652)

Improvements in the details of the preparation of diborane by the reaction between lithium borohydride and boron trifluoride etherate are reported. Modifications have been made chiefly to ensure safer working conditions. A full description of procedure is given. Methods for transferring diborane are considered.

TRITIUM AND TRITIUM COMPOUNDS

3922

Los Alamos Scientific Lab.
THE DENSITIES OF LIQUID TRITIUM, 20.6° TO 29° K. E. R. Grilly. Mar. 19, 1951. 8p. (LA-1224)

Most of a 70-cc (STP) sample of $T_2$ (containing 2.0% HT) was liquefied in a pyrex bulb of 58-$mm^3$ capacity between two fixed marks. The amount of gas used for this filling gave the difference between liquid and gas density. The tabulated results are corrected for gas density and for the presence of HT. (auth)

3923

ISOTOPE SHIFTS IN THE BALMER SPECTRUM OF TRITIUM. H. Pomerance and D. Terranova. Am. J. Phys. 18, 466-7(1950) Oct. (Note)

Brief report is made of the preparation, in 1944, of T by slow-neutron capture in Li. To verify that the activity arose from T, the isotope shift of the Balmer lines was examined. From measurements of a film exposed with a slit 10-$\mu$ wide, which corresponded to a line breadth of 0.07 A, the T shift was found to be 2.36 ± 0.05 A from $H_\alpha$ (6562.8 A).

URANIUM AND URANIUM COMPOUNDS

3924

National Bureau of Standards
PROPERTIES OF URANIUM PENTAETHOXIDE. (Excerpt from A-3923) T. I. Taylor, E. R. Smith, J. L. Torgesen, H. Matheson, and J. K. Taylor. Feb. 15, 1946. Decl. Apr. 19, 1951. 58p. (AECD-3144)

The preparation and purification of $U(OC_2H_5)_5$ are described, and the thermal stability, density, coefficient of thermal expansion, surface tension, viscosity, refractive index, spectral transmittancy, dielectric constant, vapor pressure, and other measured properties are presented in detail. This report will appear in National Nuclear Energy Series, Div. VIII, Vol. 11B. 26 figures.

3925

Los Alamos Scientific Lab.
THE HEAT OF COMBUSTION OF THORIUM AND URANIUM. Charles E. Holley, Jr., Elmer J. Huber, Jr., and E. H. Meierkord. [nd] 13p. (AECU-1294; LADC-960)

Measurements have been made of the heat of combustion of Th, U, and $UO_2$ in an $O_2$-bomb calorimeter. The experimental procedure is described briefly. From the experimental results the heat of formation of $ThO_2$, $UO_2$, and $U_3O_8$ can be calculated. The heat of formation of $ThO_2$ was found to be −1223.9 ± 3.7 absolute kj/mole. When U was burned by itself in $O_2$ the composition of the resulting oxide varied somewhat with the $O_2$ pressure but the composition corresponded approximately to the formula $U_2O_5$. When U was mixed with $UO_2$ and burned the product was $U_3O_8$. The $UO_2$, when burned by itself, was converted to $U_3O_8$. A value for $\Delta H$ of −311.65 ± 0.47 absolute kj/mole was found for the reaction $3UO_2 + O_2 = U_3O_8$. The heat of formation of $U_3O_8$ was found to be −3572 ± 9 absolute kj/mole based on the heat of combustion of U − $UO_2$ mixtures. By combining these results, the heat of formation of $UO_2$ is calculated to be −1087 ± 3 absolute kj/mole.

3926

Atomic Energy Research Establishment, Harwell, Berks. (England)
THE SELF-DIFFUSION OF URANIUM IONS IN SOLUTION. K. Saddington. Dec. 1950. 13p. (AERE-C/R-626)

The self-diffusion coefficients of the U ions in perchlorate solutions having U concentrations less than 0.01M have been determined and used as a guide to the degree of aggregation which can take place in such solutions. It is concluded that up to a pH of 4.7 complex ions containing two or three U atoms are probably in equilibrium with the uncondensed uranyl ion, but that at greater pH values the particles which are present are colloidal in nature. (auth)

# ENGINEERING

3927

Great Britain
EXPERIMENTS ON SMOKE CONCENTRATION. H. London. [nd] 23p. (BI-84A)

A method of concentrating smoke by removing the greater part of the carrier gas has been investigated. An account is given of the theoretical considerations that guided the experiments and of the experiments themselves. The method utilizes the inertia of the smoke particles. 11 figures.

HEAT TRANSFER AND FLUID FLOW

3928

United Kingdom
THE HEAT TRANSFER AND PRESSURE LOSS IN FLUID FLOW THROUGH RANDOMLY PACKED SPHERES; [PART] I. W. H. Denton, C. H. Robinson, and R. S. Tibbs. June 28, 1949. 44p. (HPC-35)

Original data are given for the surface heat-transfer coefficients and the pressure loss for noncompressible fluid flow through a randomly packed bed of spheres, covering a range of flows extending into the fully turbulent region characteristic of the system. The experiments employed electrically heated spheres carrying surface thermocouples and used cooling air at pressures up to 25 atm. The results are expressed in a dimensionless form and give directly the average surface temperature of each individual sphere in the bed and the pumping power required for a heat exchanger of this type provided the heat flux distribution is known and is at least uniform at right angles to the direction of coolant flow. A tentative estimate is given of the ex-

ponent of the Prandtl group in the generalized heat transfer expression, so that these results can also be applied when the coolant fluid has a different Prandtl number to that of air. (auth)

3929

Jet Propulsion Lab., California Inst. of Tech.
PHOTOGRAPHIC STUDY OF BUBBLE FORMATION IN HEAT TRANSFER TO SUBCOOLED WATER; PROGRESS REPORT. Fred. C. Gunther and Frank Kreith. Mar. 9, 1950. 29p. (JPL-4-120)

A close-up photographic study of surface boiling in a subcooled pool of distilled water has been undertaken. The use of a stagnant pool of coolant isolated the bubble activity from the influence of forced convection. An account is given of a study of multiple-flash photographic sequences of bubble growth-and-collapse cycles taken at heat fluxes ranging from 1 to 4 Btu/in$^2$ sec. Results of temperature measurements on and near the heating surface are presented. Data on the increase of burnout heat-transfer rate resulting from increased subcooling show that a heat flux as high as 5 Btu/in$^2$ sec can be transferred to a pool of distilled water subcooled 145°F below saturation temperature. In a pool of water subcooled more than 100°F to permit high heat-transfer rates, photographs clearly indicate a surface boiling activity consisting in a random distribution of very small vapor bubbles which never detach from the heating surface, but grow and collapse hemispherically at frequencies higher than 1000 cps. The growth-and-collapse cycling of bubbles excites microconvection in the sublayer; this microconvection appears to be the dominant transport mechanism for high heat fluxes observed with surface boiling. 15 figures. (auth)

MATERIALS TESTING

3930

Knolls Atomic Power Lab.
AXIAL LOADING OF A CYLINDRICAL CONTAINER. D. P. Timo. Mar. 13, 1951. 50p. (KAPL-495)

Curves and formulas are presented from which the stresses and deflections of a circular cylindrical container and its end plate may be obtained for the case of uniform loading applied normal to the end plate. (auth)

3931

DIRECT EXPLOSION TESTS OF WELDED JOINTS. G. S. Mikhalapov. Welding J. Research Suppl., 1-15(1950) Mar.

Good correlation appears to exist between the load-carrying capacity of welded joints as determined by the direct explosion test and by the static loading to destruction of a fabricated structure containing steep stress gradient (hatch-corner-type specimens). Wide differences appear to exist in the energy necessary to fracture and in the extent of plate deformation prior to fracture of ferritic steel plate, particularly at subzero temperatures, depending on the chemistry and heat treatment. The strength of welded joints is in nearly all cases lower than the strength of the plate forming the joints, the decrease becoming severe at below freezing temperatures. The strength of a welded joint made with 6010 electrode from carbon-manganese steel is only half the strength of the prime plate at 30°F and one-tenth at −40°F. The strength of the welded joint cannot be predicted from the performance of the plate forming the joint and of the weld metal, but is a complex function of both. 22 figures. (auth)

# MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

3932

Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS. F. H. Norton. Apr. 1, 1951. 11p. (NYO-598)

Measurement of thermal conductivity of stabilized zirconia, alumina, and magnesia, as well as B + W K-28 insulating brick, has been completed. Recommended values are included. Samples of BeO and mullite are being tested at present. A minor effect on the thermal conductivity of alumina on reheating seems to have been established. The effect of certain variables on thermal conductivity measurement has been investigated. An inductively heated tester is being tested. A linear flow tester has been constructed and appears satisfactory. Methods of forming pure $TiO_2$, $MgAl_2O_4$, ZnO, $ZrSiO_4$, and ZrN are being investigated. 5 figures. (auth)

3933

Alfred Univ.
PERIODIC STATUS REPORT NO. 22; FUNDAMENTAL PROPERTIES OF METAL-CERAMIC MIXTURES AT HIGH TEMPERATURES; PROGRESS DURING PERIOD AUGUST 1 TO SEPTEMBER 30, 1950. W. B. Crandall and W. G. Lawrence. Sept. 30, 1950. 14p. (NP-1779)

Pure intermetallics and intermetallic-ceramic mixtures were formed by several methods; for pure intermetallics, hot-pressing, neutral atmosphere firing, flash firing, and spot-welding were carried out. For intermetallic-ceramic systems, thermite reaction, addition, and partial oxidation were used. Oxidation resistance was determined on selected specimens, and an oxidation resistance number was assigned to each. X-ray-diffraction analyses were made on each of 38 specimens and checked. Phase identification is discussed.

3934

NEPA Div.
AN INVESTIGATION OF THE USE OF PHOSPHATES FOR COATING BERYLLIUM CARBIDE UNDERBODIES CONTAINING ADMIXED GRAPHITE. T. H. Elmer. Apr. 1951. 10p. (NEPA-1805)

The feasibility of using phosphate glazes as coatings for underbodies composed of $Be_2C$ and graphite was investigated. It was found that the phosphates are readily reduced at temperatures below 1400°C by carbon and $Be_2C$. The glassy phase was destroyed in the course of reduction, leaving a loose oxide layer on the surface of the underbody. P was lost from the phosphate compounds during the reduction. Phosphates were found to be reduced more rapidly by $H_2$ than by $Be_2C$. $LaPO_4$ and $CePO_4$ were found to be stable at temperatures up to 1700°C, whereas all other phosphates investigated were found to decompose partially or completely at much lower temperatures. (auth)

3935

VOLUME CHANGE AT THREE TRANSITIONS IN $BaTiO_3$ CERAMICS. Gen Shirane and Akitsu Takeda. J. Phys. Soc. Japan 6, 128-9(1951) Mar.-Apr. (Note)

Note is made of the measurement of the linear thermal expansion of $BaTiO_3$ ceramics at temperatures from −170 to 200°C. The dielectric constant curve of this specimen, prepared from pure $TiO_2$ and $BaCO_3$, shows three peaks at −77, 16, and 125°C corresponding to the known three transitions. The changes of unit cell volume at the three transitions are estimated as +0.008 $A^3$ (at −77°C), −0.015 $A^3$ (at 16°C), and −0.070 $A^3$ (at 125°C).

## METALS AND METALLURGY

3936

Knolls Atomic Power Lab.
RECRYSTALLIZATION AND GRAIN GROWTH. J. E. Burke and D. Turnbull. [nd] 138p. (AECU-1120)

The transformation which occurs during annealing of metals has been investigated, and the resulting data are reported in detail. The effects of variables on the linear rate of grain growth and nucleation frequency are considered. Two general types of theories for recrystallization nuclei are discussed. One, called the conventional nucleation theory, supposes nuclei to grow in a highly strained part of the matrix by a sequence of thermal fluctuations from original dimensions approaching those of the atom. A second type of theory supposes that the nuclei are small "blocks" or crystallites of the cold-worked matrix and that the nucleation period results from an initial slow growth rate of the blocks. Detailed studies have been made of grain growth after recrystallization, recrystallization textures, and annealing twins. 33 figures. 112 references.

3937

Los Alamos Scientific Lab.
A NEW DESIGN VACUUM MELTING FURNACE. J. M. Taub and D. T. Doll. July 18, 1950. 24p. (AECU-1212)

A design is given for a flexible and durable vacuum melting furnace, capable of melting and casting 5 to 50 lb of metal under pressure of the order of 1 $\mu$ Hg. The furnace consists of two stainless steel watercooled shells, the upper containing the melting and the pouring crucible, and the lower section containing the mold. The lower section is heated by a resistance heater; in the upper section, either resistance or induction heating is used. A readily accessible mounting is described, as is a mode of operation. (auth)

3938

[Bureau of Mines]
CORROSION STUDIES ON TITANIUM AND ZIRCONIUM METALS; SEMIANNUAL REPORT FOR DECEMBER 1950. L. B. Golden, I. R. Lane, Jr., E. V. Rhoderick, J. T. Pons, W. R. Acherman, and W. Mace. [nd] 30p. (AECU-1299)

Results are tabulated of tests on the corrosion resistance of Zr and Zr alloys in HCl (embrittlement tests), $H_2SO_4$, $H_3PO_4$, and organic acids. A comparison was made of the relative corrosion resistance of arc-melted Zr and Zr induction-melted in graphite. Ti was tested in $H_2SO_4$ and $HNO_3$ and in $Na_3PO_4$ and $SnCl_4$ solutions. Stainless steel was tested in $H_2SO_4$, $HNO_3$, HCl, and $H_2PO_4$, in $H_2SO_4$ − $HNO_3$ mixtures, and in aqua regia. The following compounds were used in carrying out tests on Ti, Zr, and stainless steel: cupric, mercuric, Ni, Mn, stannic, Al, Ca, Na, and ammonium chlorides. These three metals also were tested in various rocket fuels and were submitted to 30-day salt-spray tests in 3% NaCl solution and in synthetic ocean water.

3939

Dow Chemical Co.
PREPARATION OF HIGH PURITY MAGNESIUM AND A STUDY OF THE EFFECT OF NON-METALLIC AND ALKALI METAL IMPURITIES ON THE CORROSION CHARACTERISTICS OF PURE MAGNESIUM; FIFTH QUARTERLY REPORT; DECEMBER 1, 1950 - FEBRUARY 28, 1951. Apr. 13, 1951. 36p. (COO-43)

Corrosion studies of pure magnesium contaminated with various amounts of Fe (15 to 680 ppm) and P (0 to 2900 ppm) indicate that these elements in combination can exhibit either high or low corrosion resistance depending on their ratio. The critical ratio of Fe/P is at approximately 1.0 provided that the Fe exceeds 7 ppm. The corrosion data obtained from the carbide and the carbide plus Fe contamination studies are inconclusive at this time. A series of $Na_2SO_4$ solutions were evaluated as a corrosion medium. Attempts were made to utilize specimens coated with clear lacquer in order to evaluate localized corrosion (high-humidity test) due to intentional additions of nonmetallics to pure Mg. A number of specimens were given alternate immersion exposures to 3% NaCl for various periods of time and are reported. Earlier purification studies showed the last traces of Al to be difficult to remove. The use of pure graphite granules in connection with the usual triple-layer ⅛-in.-screen filter is effective in removing all traces of Al from Mg during the sublimation process. Data on the operation of the new sublimation vacuum casting unit, as well as the analytical results, are presented.

3940

Carnegie Inst. of Tech.
PROGRESS REPORT FOR JANUARY, FEBRUARY, MARCH, 1951. R. Smoluchowski, L. Couling, R. Flanagan, C. W. Haynes, B. Sawyer, and R. Turner. Apr. 26, 1951. 4p. (NYO-520)

The status of studies on diffusion across grain boundaries in Cu-Zn alloy and in Bi crystals, diffusion in body-centered-cubic material, modifications in the x-ray small-angle-scattering camera, and magnetic recrystallization in Fe – 30% alloy is stated briefly.

3941

Pittsburgh Univ.
PROGRESS REPORT FOR JANUARY 1, 1951 - APRIL 1, 1951; THE APPLICATION OF CHEMICAL THERMODYNAMICS TO THE STUDY OF METALLIC ALLOY FORMATION. W. E. Wallace, R. S. Craig, and F. A. Trumbore. Apr. 10, 1951. 24p. (NYO-753)

The cell $Mg(s)/Mg^{++}$ (in LiBr-RbBr)/Mg in Cd(s) was employed to determine the changes in heat content, free energy, and entropy accompanying the formation of solid Mg-Cd alloys between 270 and 300°C. The alloys are formed with an evolution of heat amounting to a maximum of 2.02 kcal/g-atom at 42 at. % Mg. The alloys are formed with a release of free energy at all compositions, and the variation of free energy with composition indicates a stable single phase system over the entire composition range. An entropy increase accompanies the formation of the alloys. A comparison of the observed entropy with the ideal entropy of mixing shows a pronounced deficiency for alloys having compositions around 50 at. % Mg. This has been attributed to the existence of short-range order. An entropy excess is evident in the Cd-rich alloys, explained as the existence of vacant lattice sites to the extent of 2 to 3% and/or exceptionally large vibrational freedom in high-Cd alloys.

3942

New York Operations Office
DIFFUSIONLESS PHASE CHANGES IN METALS; PROGRESS REPORT FOR JUNE, JULY, AND AUGUST 1950. T. A. Read, L. C. Chang, M. W. Burkart, D. S. Lieberman, and S. Zirinsky. [nd] 2p. (NYO-757)

The Au-Cd $\beta$ alloy containing 47.5 at. % Cd undergoes a diffusionless transformation from an ordered body-centered cubic structure ($\beta_1$) to an orthorhombic structure ($\beta^1$) on cooling to about 60°C and a reverse transformation from $\beta^1$ to $\beta_1$ on heating to about 80°C. Transformation characteristics of single crystals of this alloy were investigated by means of x-ray analysis of the orientation relationships, electrical resistivity measurements, and motion picture studies of the movement of boundaries between the new and old phases during transformation. (auth)

3943

New York Operations Office
DIFFUSIONLESS PHASE CHANGES IN METALS; PROGRESS REPORT FOR SEPTEMBER, OCTOBER, AND NOVEMBER 1950. T. A. Read, L. C. Chang, M. W. Burkart, D. S. Lieberman, and S. Zirinsky. [nd] 3p. (NYO-758)

The orthorhombic phase alloy of the Au-Cd system transformed by the multiple-interface mechanism from a single crystal of the $\beta_1$ phase possesses a characteristic pseudo-rubberlike behavior. Stress-strain curves of this alloy within the quasi-elastic range were obtained at room temperature. Accurate x-ray determinations of the lattice parameters of single crystals of both $\beta_1$ and $\beta^1$ phases were made. The atomic displacements and crystallographic mechanism involved in the transformation were studied both experimentally and theoretically. (auth)

3944

New York Operations Office
DIFFUSIONLESS PHASE CHANGES IN METALS; PROGRESS REPORT FOR DECEMBER 1950, JANUARY AND FEBRUARY 1951. T. A. Read, L. C. Chang, M. W. Burkart, D. S. Lieberman, and S. Zirinsky. [nd] 3p. (NYO-759)

The kinetics of interface motion in the Au – Cd system during single-interface transformation was studied in detail. The linear rate of movement of interface was found, within the limits of experimental error, to be almost directly proportional to the rate of change of temperature of the specimen. For a given specimen the rate of movement of interface on cooling is greater than that on heating. Experimental evidence of diffusion-controlled relaxation at the interface was found. X-ray determinations of the coefficients of thermal expansion of the $\beta_1$ and $\beta^1$ phases were made. Techniques of nondestructive x-ray chemical analysis of single crystals of $\beta^1$ alloy with a precision of 1 in 50,000 were developed. (auth)

3945

COMMERCIAL USES OF ZIRCONIUM DEVELOPING. G. L. Miller. Iron Age 167, 83-7(1951) May 17.

The methods used at the Murex Ltd. plant in Rainham, England, for production of ductile Zr are explained. A modified Kroll practice for sponge production is used. The split-tube graphite resistor-type furnace which is used for melting has been found to be most successful. The production of sheet from the ingot metal is described. Usually the Zr is sheathed, but some work has been done with good results on hot-working unsheathed metal at 650°C. Deep drawing or cupping of Zr has been achieved to a limited extent. The work indicates that so long as the metal is annealed, and welding or galling can be prevented by the use of oxidized surface and lubricants, deep drawing of Kroll Zr is a practical proposition. Turning, milling, and shaping operations can be achieved with high-speed steel tools, provided a keen cutting edge is maintained. Machine parts, sheet, rod, and wire are all available. Fusion welding by the argon arc process makes sound welds, but ductility has still to be achieved.

3946

THE CONSTITUTION OF TITANIUM-RICH ALLOYS OF IRON AND TITANIUM. H. W. Worner. J. Inst. Metals 79, 173-88(1951) May.

Metallographic and x-ray methods have been employed to establish the general outline of the constitutional diagram

for the Ti-rich portion of the Ti–Fe system. The results of the investigation indicate that addition of Fe causes a depression of both the freezing point and the $\alpha \rightleftarrows \beta$ transformation temperature of Ti. From the melting point of Ti, the liquidus and solidus fall steeply to a eutectic horizontal at 1060°C, the eutectic composition being at 29 at. % Fe. This eutectic consists of an intermetallic phase (FeTi), possessing a body-centered cubic structure, and a solid solution of Fe in the high-temperature ($\beta$) form of Ti. The maximum Fe content of the $\beta$ solid solution is approximately 22 at. % at the eutectic temperature. At lower temperatures, the $\beta$ solid solution field tapers to a eutectoid point at 15.5 at. % Fe, the temperature being approximately 600°C. The eutectoid transformation, which is very sluggish, yields FeTi and $\alpha$ Ti containing less than 0.8 at. % Fe in solid solution. (auth)

3947

CONTINUOUS METHOD OF DIFFERENTIAL ANALYSIS; ITS APPLICATION TO HYDRATED BERYLLIUM CARBONATE. Haldun Terem. Rev. faculté sci. univ. Istanbul 11A, 107-18(1946) July. (In French)

The decomposition by heating of some hydrated (or basic) carbonates or nitrates does not proceed in two stages separated in time; the liberation of $CO_2$ or $NO_2$ begins before all $H_2O$ has been removed. In these cases the thermogravimetric method cannot give information on the course of the reactions. Another procedure is proposed, in which the sample is heated in a stream of air; the liberated gases are retained in a series of weighed tubes containing absorbing substances. By using two such series of tubes, connected with the heated sample by a three-way cock, each series can be periodically disconnected and weighed. As part of a study of the dissociation of Be compounds, experiments were made with a salt whose composition could be represented as $BeCO_3.5Be(OH)_2.3H_2O$. It was found that this substance should be regarded as a mixture of the neutral carbonate and the hydroxide, and that the activation energy of the $BeCO_3$ dissociation was 13,800 cal.

3948

CONTRIBUTION TO THE STUDY OF THE CRYSTALLOGRAPHIC MECHANISM OF HARDENING OF DURALUMINS. H. Lambot. Acad. roy. Belg. Classe sci. Mém. 26, 1-96(1950). (In French)

An x-ray study of structural changes accompanying the spontaneous hardening of some Al alloys (duralumins) was made. The hardening occurs a few hrs after tempering, when the metal is left at room temperature or annealed below 200°C. The accompanying crystallographic changes are observed as abnormal x-ray-diffraction patterns. The observations, made on monocrystals of Al-Mg-Si, Al-Cu-Mg-Si, and Al-Cu-Mg alloys, revealed the formation of long strings of Cu, Mg, and Si atoms oriented along one of the principal directions of the Al lattice. At 200° this process of intracrystalline precipitation tends to become more homogeneous in its spatial distribution, and is replaced at annealings above 300° by the formation of stable phases consisting of microcrystals of $Mg_2Si$, $CuMg_2Si_4Al_4$, and $Cu_2Mg_2Al_5$. On the basis of these observations, a theory of hardening of alloys is proposed. Small and scattered irregularities in the crystal lattice caused by the presence of foreign atoms serve as guide points in the intracrystalline glides produced by external stresses, and thus contribute to the alloy's softness; on the other hand, oriented strings or plates of these atoms precipitated from metastable states of the alloy form obstacles for the propagation of the glides and contribute to the alloy's hardness.

3949

NEPA Div.
ELECTRICAL RESISTIVITY OF COMMERCIALLY PURE TITANIUM AS A FUNCTION OF TEMPERATURE. F. K. Lampson, G. H. Rowe III, J. J. Droher, and J. Draghic. Apr. 16, 1951. 10p. (NEPA-1826)

The electrical resistivity of Mg-reduced commercial Ti metal has been determined over the range from room temperature to 2500°F. The material exhibited metallic behavior, in confirmation of statements made by other investigators. Ti is sensitive to contamination above 1600°F, and such an occurrence leads to a broadening of the transition range, with the concurrent decrease in resistivity resulting in apparent semiconductor behavior. This phenomenon is believed to be responsible for those statements in the literature wherein some investigators have reported nonmetallic (semiconductor) characteristics of Ti at elevated temperatures. 5 references. (auth)

3950

ELECTROLYSIS OF ALUMINUM SOLUTIONS IN A MAGNETIC FIELD. Charles E. Wood and C. W. Tittle. J. Chem. Phys. 18, 1683(1950) Dec. (Letter to the editor)

The formation of a molten-mass-like deposit on the Al anode of an aqueous $Al_2(SO_4)_3$ electrolytic cell in the presence of a 2000-gauss magnetic field, reported by Antonoff and Rowley (J. Phys. & Colloid Chem. 52, 1105-8(1948)), has not been confirmed by similar experiments with fields up to 8160 gauss at numerous variations of potential difference, current, time, concentration, temperature, and type of anode. Corrosion of the anode tended to be somewhat more pronounced with the magnetic field, possibly owing to agitation of the solution by spiraling gas bubbles. No other significant magnetic effect was noted.

3951

Atomic Energy Research Establishment, Harwell, Berks. (England)
GRAIN BOUNDARY DIFFUSION IN METALS. A. D. LeClaire. Feb. 1951. 9p. (AERE-M/R-655)

By An extension of a recent analysis (Barnes, Nature 166, 1032(1950); Fisher, General Electric Research Lab. Report GEPM-18) of the problem of grain-boundary diffusion in metals, the expression $D'/D = 1/\delta\ 2(\pi Dt)^{1/4} \cot^3 \alpha$ has been derived relating the diffusion coefficients D′ and D for grain boundary and for volume diffusion, $\delta$ the effective "width" of the grain boundary, and $\alpha$ the angle at time t between the grain boundary and a line of constant concentration at the point where it meets the grain boundary. The use of the equation is discussed. When it was applied to a recent experimental observation on grain boundary diffusion of Cu in Ni, the result was deduced for $D' = 8$ $cm^2$/day at 1000°C. Aspects of the relation of other work on grain boundaries to grain-boundary diffusion are dis-

cussed. Evidence is presented, based on models of the grain boundary, which suggests that the activation energies for grain boundary and for volume diffusion may not differ appreciably. 13 references. (auth)

3952

HEAT CAPACITY OF LIQUID MERCURY BETWEEN 0° AND 450°C; CALCULATION OF CERTAIN THERMODYNAMIC PROPERTIES OF THE SATURATED LIQUID AND VAPOR. Thomas B. Douglas, Anne F. Ball, and Defoe C. Ginnings. J. Research Natl. Bur. Standards 46, 334-48(1951) Apr.

The enthalpy of liquid Hg was measured from 0 to 450°C by the "drop" method. These and other precise published data were used to calculate a number of thermodynamic properties of liquid and gaseous Hg at the vapor pressures from the triple point, −38.88 to 500°C. The entropy calculated from data on the vapor and liquid was compared with that derived from published low-temperature heat-capacity data for the solid. The calculated values of vapor pressure were found to agree over a wide temperature range with certain published experimental values when independently derived gas-imperfection and published temperature-scale corrections were applied. 8 tables. (auth)

3953

ON THE ACTIVATION ENERGY OF THE REACTION $BeO.H_2O \rightarrow BeO + H_2O$. Haldun Terem. Rev. faculté sci. univ. Istanbul 11A, 95-8(1946) July. (In French)

In a previous paper (Rev. faculté sci. univ. Istanbul 8A, 99 (1943)) the dissociation of Be hydroxide through heating was described. Measurements of the activation energy of this reaction are reported. Using the thermogravimetric method, the hydroxide was heated at 220, 240, 260, and 280°C, and the loss in the $H_2O$ content was plotted against the time; four variously inclined straight lines were obtained from which the activation energy was calculated to be 13,815 cal.

3954

ON THE SYSTEM BERYLLIUM OXIDE-WATER. Haldun Terem. Rev. faculté sci. univ. Istanbul 8A, 99-111(1943) Apr. (In French)

As part of an investigation of corrosion oxidation of Be, problems of the constitution of Be hydroxide, of its dehydration, and of the rehydration of the oxide were studied. By using the thermogravimetric method of Guichard (Bull. soc. chim. France 37, 62(1925)) in which the dehydration process is recorded as the temperature increases uniformly with time, the hitherto unsettled question of the number of Be hydroxides (of neighboring compositions) could receive a definite answer. There exists only one hydroxide, of the exact formula $BeO.H_2O$ and exhibiting a marked chemical individuality. Ebullition does not disintegrate it, the proper dehydration process taking place at 220 to 280°C; however, a small quantity of $H_2O$ remains even at higher temperatures. The product left after a calcination at 300 to 400° is more or less hydroscopic, this property decreasing with increasing calcination temperature.

3955

PARTICLE AGGLOMERATION IN TUNGSTEN METAL POWDER. Bernard Kopelman and C. C. Gregg. J. Phys. & Colloid Chem. 55, 557-63(1951) Apr.

Analysis of the particle diameter of W metal powder in liquids of various dielectric constants indicated: (1) that over a wide range of dielectric constant, the apparent particle size is inversely proportional to the fourth root of the dielectric constant of the medium; (2) that the surface bonds in the metal powder due to electrical attraction are completely broken in associated liquids whose dielectric constant is 25; (3) that essentially complete agglomeration of the powder occurs in liquids of dielectric constant less than about 2; and (4) that the metal powder with an average particle size of 4.2 $\mu$ would be expected to behave in vacuum or air as a powder with an average particle diameter of about 10 $\mu$. The photelometer is reported to be a useful tool for the analysis of particle size and distrubition. It can aid in measuring the degree of flocculation present in a suspension. (auth)

3956

Naval Research Lab.
RELATION OF CASTING QUALITY TO GATING PRACTICE. William H. Johnson, Harold F. Bishop, and William S. Pellini. Jan. 4, 1951. 13p. (NRL-3786)

Studies have been made of the effects of gate design and associated metal-flow conditions on casting quality. It was found that tht type of gating employed for steel and iron is unimportant provided inflow velocities are not so excessive as to cause deterioration of the mold. Drossing metals, however, such as Al and Mn bronze, require specialized gating procedure to ensure a minimum of metal-to-air contact in gate and mold. The use of moderately choked systems is indicated as best practice for these metals. (auth)

3957

THREE BASIC STAGES IN THE MECHANISM OF DEFORMATION OF METALS AT DIFFERENT TEMPERATURES AND STRAIN-RATES. W. A. Wood, G. R. Wilms, and W. A. Rachinger. J. Inst. Metals 79, 159-72(1951) May.

In previous work it has been shown that as the temperature of deformation of Al is increased, or as the rate of strain at any one temperature is decreased, the familiar mechanism of slip is replaced progressively by a second mechanism which has been termed the "cell mechanism." In this, the deformation involves a dissociation of the grains into separate elements that increase in size with increase in temperature and decrease in strain rate. It is shown that by further reduction in the strain rate at an elevated temperature, the cell mechanism is in turn superseded; this occurs when the cells become comparable in size with the grain itself. This third stage is termed "boundary microflow." The nature of the observations suggests that no other major change is likely to be observed as the rate of strain is further reduced. A short review is given of the position now reached, and the implications are discussed in relation to the mechanism of deformation, strain hardening, and creep. (auth)

MINERALS AND MINERALOGY

3958

Carbide and Carbon Chemicals Corp., Y-12
PROGRESS REPORT ON CARNOTITE STUDIES; CARBONATE PROCESS. K. B. Brown and C. F. Coleman. July 1949. Decl. Apr. 26, 1951. 25p. (AECD-3140; Y-460)

Work on the carbonate process has continued to be directed toward the determination of maximum build-up of U in the carbonate liquors during the leaching of raw and salt-roasted ores. The data on the build-up of materials other than U and V during the 6% $Na_2CO_3$ and 9% $Na_2CO_3$ cascade experiments (Y-441) are now available and have been included in this report. The solubility studies on synthetic and natural carnotites in aqueous systems of $Na_2CO_3$, $NaVO_3$, and NaCl have continued. In addition to the solubility studies on carnotites, determinations are in progress on the solubility of pure $Na_4UO_2(CO_3)_3$ in similar systems. In the yellow-cake precipitation study, tests have been made in the presence of phosphate, and in the absence of chloride. Tests with low chloride and low V have given good results from synthetic solutions and from an actual leach of raw Indian Reservation ore. Precipitation of a V phosphate (assumed to be vanadyl) from synthetic purified liquors has decreased the V content to a few ppm.

3959

A LABORATORY WET MAGNETIC SEPARATOR FOR STRONGLY MAGNETIC MINERAL SANDS. W. R. B. Martin. New Zealand J. Sci. Technol. 31B, 5-21(1949)

A laboratory-size separator is described in detail. Feed arrangements for both wet and dry sands are given. With a nominal throughput of 280 lb/hr to give a commercial grade concentrate, the separator is capable, at reduced capacity, of yielding an exceptionally high-grade uniform concentrate. This separator was built primarily as a means of obtaining several cwt of Taranaki iron sand for some technical scale work on a Ti and V extraction process.

# PHYSICS

3960

Ames Lab.
NOTE ON THE CALCULATION OF RESISTANCE. J. F. Carlson. May 5, 1951. 17p. (AECU-1300)

The resistance of a conductor with given boundary conditions is shown to be obtainable from the solution of an integral equation of the first kind. Under specified conditions an approximate solution of the integral equation is found which allows an approximate calculation of the resistance. The method is illustrated by two simple examples. (auth)

3961

Case Inst. of Tech.
A NOTE ON ATOMIC BINDING ENERGIES. (Technical Report No. 7). L. L. Foldy. [nd] 9p. (AECU-1317)

By the use of Dickinson's recent calculations (Phys. Rev. 80, 563(1950)) of the diamagnetic field for atoms based on Hartree calculations, and a theorem due to Feynman, an expression is obtained for the total binding energy of the electrons in an atom as a function of atomic number. The results are compared with predictions of the Fermi-Thomas statistical model. It is found that the binding energy for small Z varies as $Z^{7/3}$ in accord with the statistical model, but for high Z the dependence on Z becomes approximately $Z^{12/5}$. The equation for the binding energies is estimated to be correct to 5% or better. (auth)

3962

Columbia Univ.
PROGRESS REPORT; [SECOND QUARTERLY PROGRESS REPORT FOR FISCAL YEAR 1950-1951]; NUCLEAR PHYSICS LABORATORIES. J. R. Dunning, Director. Dec. 31, 1950. 32p. (CUD-65; DR-1578)

Separate abstracts have been prepared on the following sections of this report: Neutron Velocity Spectrometer Transmission Measurements, sect. I; Neutron Scattering Experiments, sect. II; Analytical Laboratory and Crystal Growing, sect. III; Radiochemical Laboratories, sect. IV; Instrument Development, sect. V; and Light Particle Investigations, sect. VI.

3963

Ames Lab.
PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1950, TO DECEMBER 31, 1950. G. W. Fox, W. C. Caldwell, J. F. Carlson, G. C. Danielson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller, and D. Zaffarano. Mar. 15, 1951. 42p. (ISC-135)

Separate abstracts have been prepared on the following sections of this report: Radiation Studies, p.6-12; and Solid State Physics, p.21-39.

3964

PHYSICAL BASES OF THE HANDLING OF ARTIFICIAL RADIOACTIVE ISOTOPES. Luise Meyer-Schützmeister. Naturwissenschaften 37, No. 22, 501-17(1950) Nov. (In German)

Most of the radioactive isotopes used by German scientists are furnished to them by Harwell. A long list of these products and their radioactive characteristics is given, as well as many decay diagrams. The principal ionization and decay units (c, r, rep), the sensitivity of Geiger counters to $\beta$ and $\gamma$ rays, and the range-energy relationships are explained, and tolerance doses and thicknesses of protection screens are indicated.

3965

PIEZOELECTRIC PROPERTIES OF SOME TITANATES AND ZIRCONATES OF BIVALENT METALS THAT POSSESS A PEROVSKITE-TYPE STRUCTURE; trans. from Zhur. Tekh. Fiz. 20, No. 2, 137-47(1950). G. A. Smolenskiy. 1950. 11p. (NP-2296; U-1292; OO-W-17631)

The dielectric permeability of some titanates and zirconates of bivalent metals that possess the structure of perovskite was investigated. It was found that $CdTiO_3$, PbTiO , and PbZrO and also the solid solutions (Ca,Pb)TiO and (Sr,Pb)$TiO_3$ are piezoelectric. It was proved that the Curie temperature of these piezoelectrics is most influenced by the degree of covalence of the lattice bond and by the dimensions of the oxygen octahedron, which contains Ti ion. It was proved that piezoelectrics of this type have a tetragonal lattice below the Curie point. (auth)

3966

THE THEORY OF HELIUM-III; trans. from Zhur. Eksptl'. i Teoret. Fiz. 20, No. 10, 919-24(1950). I. Pomeranchuk. 1950. 10p. (NP-2290)

The temperature dependence of thermal capacity, viscosity, and thermal conductivity in $He^3$ has been determined, and studies have been made of the influence of exchange effects upon the phase transition of liquid $He^3$ to the solid state. The heat of fusion of $He^3$ at low temperatures has been found to be negative and equal to $-R \log 2$. Theoretical possibilities of obtaining temperatures of the order of $10^{-6}$ to $10^{-7}$°K during adiabatic freezing of liquid $He^3$ are indicated. Certain peculiarities of the nuclear magnetic susceptibility have been considered. 13 references.

ASTROPHYSICS

3967

MATTER AND ENERGY UNDER COSMIC CONDITIONS. H. Kienle. Naturwissenschaften 38, 92-100(1951) Feb. (In German)

In the energy balance sheet of the universe the quantities of only two forms of energy are comparable with that of the rest energy of matter, viz., the potential energy of gravitation and the kinetic energy of the nebulae in the general expansion of the universe. Compared to these, all other kinds of energy are present in negligible quantities. If the mean density of matter in the cosmos is $10^{-27}$ g/cm³, an equality must exist between the absolute values of the negative potential energy of gravitation and the sum of the two positive items, viz., mass and expansion. This idea of the zero total energy of the universe was postulated in Jordan's recent cosmological speculations. However, it is preferable to accept a lower value for the mean matter density, viz., $10^{-28}$ g/cm³. On this basis the three energy items, matter, gravitation, and expansion, are found to be equal, respectively, to 2.0, 0.1, and 0.6 multiplied by $10^{75}$ erg or $10^{54}$ g. In the present state of the universe the "materialized" part of its energy consists predominantly of nucleons (protons and neutrons) the number of which is $10^{79}$. About 97% of all existing nuclei are H and He. About 10% of all matter is accumulated in the white-dwarf stars in the form of a degenerate gas; this is probably a significant fact in the cosmologic history of matter.

COSMIC RADIATION

3968

THE ALTITUDE AND LATITUDE VARIATION IN THE RATE OF OCCURRENCE OF NUCLEAR DISINTEGRATIONS PRODUCED IN THE STRATOSPHERE BY COSMIC RAYS. J. J. Lord. Phys. Rev. 81, 901-9(1951) Mar. 15.

The variation with altitude of the rate of production of stars in photographic plates was measured from mountain elevations to 94,000 ft at geomagnetic latitude $\lambda \approx 54$°N. The type of particle initiating each star was determined, and it was shown that the total flux of star-producing protons decreased rapidly from 94,000 to 11,500 ft and was compatible with an absorption mean free path of 145 g/cm². The total flux of star-producing neutrons showed a maximum near 70,000 ft and then decreased with altitude with an absorption mean free path of 170 g/cm². Similar altitude dependence measurements were made at $\lambda \approx 28$°N which showed that the rate of production by neutrons of stars of 3 to 9 prongs at 94,000 ft was 0.19 of the corresponding value at $\lambda \approx 54$°. This demonstrates that 81% of the small stars at $\lambda \approx 54$° must be due to the primary particles of the cosmic radiation in the energy intervals given by the geomagnetic cutoff at $\lambda \approx 28$° and $\lambda \approx 54$° (1 to 8 bev for protons, and for $\alpha$ particles and heavy nuclei 0.35 to 3.5 bev/nucleon). The total flux of star-producing protons varies by a factor of 3.0 between these two latitudes at 94,000 ft and shows that 67% of the proton-initiated stars at $\lambda \approx 54$° are due to primary particles of the energies given. (auth)

3969

AN EXAMPLE OF THE (n,p; $\pi^-$) REACTION IN THE PHOTOGRAPHIC EMULSION. S. J. Goldsack and N. Page. Phil. Mag.(7) 42, 570-2(1951) May. (Correspondence)

A photograph of a nuclear reaction recorded in an emulsion at altitude 2860 m in a magnetic field of 34,000 gauss is presented. The event is interpreted as the production of a $\pi^-$ meson in the collision of a high-energy, cosmic-ray neutron with a proton in the emulsion, according to the scheme: $n + p \rightarrow p + p + \pi^-$. The technical details of the event are discussed.

3970

THE INTENSITY OF THE TOTAL AND OF THE HARD COMPONENT OF THE COSMIC RADIATION AS A FUNCTION OF ALTITUDE AT GEOMAGNETIC LATITUDES OF 28°N AND 55°N. M. Vidale and Marcel Schein. Phys. Rev. 81, 1065-6(1951) Mar. 15. (Letter to the editor)

The results of two balloon experiments carried out at geomagnetic latitudes of 28 and 55°N are presented. The equipment used consisted of four fourfold coincidence-counter telescopes registering each fourfold coincidence separately on photographic film moved by a clock mechanism. The maximum total radiation found at 28°N occurs at a pressure of 9 cm Hg and represents an increase by a factor of 18 over its value at sea level. At this same altitude the intensity of the cosmic radiation capable of traversing 12 cm of Pb increases by a factor of 8 from its value at sea level to a flat maximum at 9 cm Hg. The maximum of the total component at the latitude 55°N occurs at a pres-

sure of 5 to 6 cm Hg and represents an increase by a factor of 35 from its value at sea level, while the hard component, as measured through 12 cm of Pb, flattens out above 5 cm Hg and exhibits a small maximum at 3 cm Hg, increasing over the value at sea level by a factor of 19.

3971

STUDY ON STARS IN PHOTOGRAPHIC EMULSIONS. Francoise Bousser, Michele della Corte, Louis Jauneau. Ricerca sci. 21, 43-7(1951) Jan. (In Italian)

Stars produced at 28-km altitude in nuclear emulsions Ilford G5 were examined by plotting the ratio between numbers of stars with more than 8 prongs and with $\leq 8$ prongs against the numbers of relativistic prongs. It follows from the shape of the curve that the number of soft prongs cannot be used as a criterion in the question whether the evaporated nucleus was a heavy or light one. The dependence of star frequencies on the number of relativistic particles show that the energy spectrum of "primaries" generated in nuclear disintegrations is poorer in high-energy particles than the spectrum of the true primaries. The angular distribution of relativistic particles does not seem to agree with the hypothesis of a purely multiple mode of production. (auth)

3972

THE TRANSITION EFFECT OF EXTENSIVE AIR SHOWERS. D. D. Millar. Nuovo cimento 8, 1-10(1951) Apr.

Measurements have been made of the transition effect of the extensive air showers of cosmic rays in absorbers of Pb, Fe, C, and water. The results indicate that the photons of the showers are predominantly of lower energies than are the electrons, and forms of the energy spectra for the two components incident on the counter trays are deduced. The discrepancy between the absorption of the showers in air and in local absorbers of similar atomic weight, such as carbon and water, is discussed briefly. (auth)

## CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

3973

Columbia Univ.
ANALYTICAL LABORATORY AND CRYSTAL GROWING, sect. III of PROGRESS REPORT; [SECOND QUARTERLY PROGRESS REPORT FOR FISCAL YEAR 1950-1951]; NUCLEAR PHYSICS LABORATORIES. J. R. Dunning, Director. Dec. 31, 1950. 3p. (CUD-65(sect.III); DR-1578)

Sample holders have been designed and built to hold microcrystalline NaF and $Na_3FeF_6$ for paramagnetic neutron scattering measurements. $FeF_3$ also has been prepared; studies on the latter are continuing. Other Fe samples are being prepared to investigate variation of $\sigma_{p.m.}$ with change in bond type and Weiss-Curie constant. A project for the production of refined anthracene and stilbene crystals has been started. The experiment on using In research transmission for the analytical determination of In in Sn is completed; other elements are being prepared for study.

## GASES

3974

DIFFUSION PROPERTIES OF GASES. PART IV. THE SELF-DIFFUSION COEFFICIENTS OF NITROGEN, OXYGEN, AND CARBON DIOXIDE. E. R. S. Winter. Trans. Faraday Soc. 47, 342-7(1951) Apr.

The diffusion rates have been measured, by mass spectrometry, of the molecules $N^{14}N^{15}$, $O^{16}O^{18}$, and $C^{13}O^{16}O^{18}$ into isotopically-normal $N_2$, $O_2$, and $CO_2$, respectively. Measurements have been performed at 0 and 45°C. The diffusion coefficients are, for $O_2$ and $N_2$, in good agreement with the predictions of the Chapman-Enskog kinetic theory of gases using the Lennard-Jones 12:6 model. The experimental results for $CO_2$ are a little higher than the theoretical figures. (auth)

## INSTRUMENTS

3975

National Bureau of Standards
NATIONAL BUREAU OF STANDARDS QUARTERLY REPORT TO THE UNITED STATES ATOMIC ENERGY COMMISSION; JANUARY 1, 1951, TO MARCH 31, 1951. Laurel S. Winslow and Paul L. Howard. [nd] 4p. (AECU-1286)

Continued work on the development of a high-voltage battery of the Zamboni pile type is reported briefly. Modifications have included replacement of water by ethylene glycol in the paper sizing or positive and the Methocel by gelatin as binder. Pilot plant production of the present-design cell is recommended.

3976

Utah Univ.
POWER SUPPLIES FOR A HIGH-FREQUENCY TRANSMITTER, TYPE BC 375-E. (Technical Report No. II). W. Hoyt Andersen and Ransom B. Parlin. Jan. 29, 1951. 11p. (AECU-1301)

Design details are given for a high-voltage power supply (1000 v-c at 0.5 amp with less than 1% ripple) which can supply voltages of 0 to 1400 v-c. A low-voltage power supply designed as a filament source for the high-voltage supply can furnish 28 v-c at 20 amp with very low ripple (at 7 amp the ripple component was found to be 0.536%). Operating curves of the two units show the percentage regulation as a function of the load current.

3977

Columbia Univ.
INSTRUMENT DEVELOPMENT, sect. V of PROGRESS REPORT; [SECOND QUARTERLY PROGRESS REPORT FOR FISCAL YEAR 1950-1951]; NUCLEAR PHYSICS LABORATORIES. J. R. Dunning, Director. Dec. 31, 1950. 3p. (CUD-65(sect.V); DR-1578)

An accurate, low-jitter pulse generator for calibration of the 10-channel pulse-height analyzer has been built. Experiments on optical efficiency of various crystal-phototube

geometries are under way. MgO has been found to be superior to Al as a reflector. The use of a thin film of $B^{10}$ + phosphor on a glass plate as neutron detector is under investigation. The $B^{10}(n,\alpha)Li^{7}$ reaction yields $\alpha$ particles which cause scintillations in the phosphor. A photomultiplier picks up the scintillation. Preliminary detectors of this type have been made. Test equipment for the wide band amplifier has been improved and new devices built. The high-resolution coincidence circuit has been tested and found to give reliable resolution ~0.2 pulse width. Further tests are in progress. A fast inductive extinguishing circuit for Geiger counters is being tested with both self-quenching and non-self-quenching Geiger counters. (auth)

3978

Raytheon Manufacturing Co.
STATUS REPORT NO. 5; CONTRACT NO. AT(30-1)-874 TO U. S. ATOMIC ENERGY COMMISSION - NEW YORK OPERATION; PERIOD OF REPORT AUGUST 15, 1950, TO SEPTEMBER 15, 1950. L. T. Jansen. 1950. 4p. (M-4510)

Brief reports on fabrication and production of high-intensity $\gamma$-ray counter tubes (QF-772) and of subminiature corona voltage regulator tubes (QF-771) are presented.

3979

Atomic Energy Project, Univ. of California, Los Angeles
THE IN VIVO DELINEATION OF THYROID GLANDS WITH AN AUTOMATICALLY SCANNING RECORDER. Benedict Cassen and Lawrence Curtis. Apr. 30, 1951. 9p. (UCLA-130)

The success of a highly collimated $\gamma$ scintillation counter in the delineation of thyroid glands in patients given $I^{131}$ has led to the designing the construction of equipment for making the delineation less tedious and more reliable. Equipment for automatic scanning and recording is described. This equipment enables a record to be obtained on which the outline of the gland can be directly visualized. (auth)

3980

Atomic Energy Project, Univ. of Rochester
DEVELOPMENT OF A COPPER SPHERE RADIOMETER, p.76-99 QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1950, THRU DECEMBER 31, 1950. R. M. Blakney, T. P. Davis, L. J. Krolak, and H. E. Pearse. Feb. 1, 1951. 24p. (UR-152(p.76-99))

In a previous quarterly report (UR-96) a general method for the measurement of short-duration, high-intensity bursts of thermal energy by means of a thin-walled Cu-sphere radiation calorimeter was described. The present report is concerned with the refinements and adaptations of the sphere calorimeter in order to incorporate it into an instrument of sufficient versatility that measurements may be made on a wide variety of sources and of sufficient ruggedness to permit its use under field conditions. The instrument is designed to measure the total integrated thermal energy incident on the receiver from any short-duration source. In addition, provisions have been made to determine the integrated energy in three adjacent spectral regions: the ultraviolet (2500 to 4000 A), the visible (4000 to 8000 A), and the near infrared (6000 to 27,000 A).

3981

Bureau of Mines
INVESTIGATION OF A PHOTOELECTRIC DEVICE FOR THE DETERMINATION OF LOW CONCENTRATIONS OF DUST. D. E. Stone, L. J. Kane, T. E. Corrigan, H. W. Wainwright, and C. B. Seibert. Mar. 1951. 13p. (BM-RI-4782)

An apparatus is illustrated which was developed for testing instruments designed for continuously determining low concentrations of dust in air. A photoelectric device which continuously compares the intensity of a light beam passing through the gas with a similar beam passing through clean air, although satisfactory in other respects, had a sensitivity of only 0.75 grain/100 $ft^3$. Work is continuing with the object of improving this factor. The calibration curve is similar to the anode-voltage curve of the phototube. Greatest sensitivity was obtained at an illumination of 0.5 $ft^{-2}c$. 6 figures.

3982

Office of Naval Research, London
A NOVEL TYPE OF PULSE HEIGHT ANALYZER. S. Fred Singer. Mar. 14, 1951. 5p. (ONRL-20-51)

A pulse-height analyzer which makes use of novel ideas for pulse-height comparison and storage and presentation of the pulse-height distribution has been developed at the Cavendish Laboratory, Cambridge University (European Sci. Notes 5, 21(1951)). Its main advantages over the conventional type of kicksorter will be higher accuracy and reliability, speed, and low cost. The new instrument uses digital computing machine techniques; by means of sequential operation it is possible to obtain up to 100 voltage channels without additional equipment. The main ideas involved in the design of the machine and its detailed operation are described. (auth)

## ISOTOPES

3983

THE ISOTOPIC COMPOSITION OF OXYGEN IN ORGANIC COMPOUNDS OF VEGETABLE ORIGIN; trans. from Doklady Akad. Nauk S.S.S.R. 72, 351-3(1950). R. V. Teis. 1950. 5p. (NP-2300)

The isotopic composition of oxygen from carbohydrates (sugar and cellulose) has been determined from a laboratory preparation of a 99.9% pure dextrose monohydrate prepared from corn and from absorbent cotton. Experimental techniques are discussed and results presented in tabular form. A more extensive abstract from the original article appeared in Nuclear Science Abstracts as NSA 4-6395.

## ISOTOPES SEPARATION

3984

Office of Naval Research, London
THE ELECTROMAGNETIC ISOTOPE SEPARATOR AT THE ZEEMAN LABORATORY, AMSTERDAM. S. F. Singer. Apr. 13, 1951. 3p. (ONRL-35-51)

A brief account is given of the facilities of the mass spectrograph laboratory of the Zeeman Laboratory, University of Amsterdam, Netherlands. Details are given on the design and expected performance of a large electromagnetic isotope separator now under construction. (auth)

## MASS SPECTROGRAPHY

3985

MASS SPECTROMETER RESOLUTION OF ION PAIRS OF SIMILAR m/e. Duane V. Kniebes, Sidney Katz, and Richard B. Bernstein. J. Chem. Phys. 19, 654-5(1951) May. (Letter to the editor)

An investigation has been undertaken to determine the limits of mass resolution of the Consolidated Mass Spectrometer, Model 21-103. Mixtures of "isobaric" pairs of ions were scanned with the instrument modified for very low scanning speeds and set for maximum resolution. The pairs studied are listed in the approximate order of decreasing ease of resolution and the galvanometer tracings for the pairs for which separation was effected are shown.

3986

MASS SPECTROSCOPY. PART II. Fernando del Valle Rodríguez, Antonio Bourgeal Ustáriz, and Ernesto Orellana Silva. Rev. cienc. aplicada (Madrid) 5, 17-27(1951) Jan.-Feb. (In Spanish)

Continuing an outline of mass spectrometry (Rev. cienc. aplicada (Madrid) 4, 481(1950)), the authors examine instruments based on the principle of double focusing, i.e., mass spectrometers of Bondy and Popper, Dempster, Bainbridge and Jordan, Strauss, Bleakney and Hipple, and others. Application of mass-spectrometric methods for the separation of isotopes is discussed. 96 references.

3987

Atomic Energy Research Establishment, Harwell, Berks. (England)
REPORT ON VISIT TO NORTH AMERICA; OCTOBER 1950. G. H. Palmer. Jan. 1951. 23p. (AERE-G/R-628)

Techniques used by various laboratories in the United States and Canada which specialize in mass spectrometer analyses are described. A number of techniques are described for the measurement of samples in both the gaseous and solid states. 9 figures.

## MATHEMATICS

3988

Research Lab. of Electronics, Massachusetts Inst. of Tech.
APPLICATION OF STATISTICAL METHODS TO COMMUNICATION PROBLEMS. (Technical Report No. 181). Y. W. Lee. Sept. 1, 1950. 41p. (NP-3062)

The basic ideas and tools in the statistical theory of communication are discussed. The methods of the theory in the formulation of some important communication problems are outlined. Some techniques which have been developed for application to practical problems, and certain laboratory results in support of the theory are described. To indicate the possibility of practical application primarily with respect to improvement of signal-to-noise ratio, experimental results are presented. (auth)

## MEASURING INSTRUMENTS AND TECHNIQUES

3989

Ames Lab.
SOLID STATE PHYSICS, p.21-39 of PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1950, TO DECEMBER 31, 1950. G. W. Fox, W. C. Caldwell, J. F. Carlson, G. C. Danielson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller, and D. Zaffarano. Mar. 15, 1951. 19p. (ISC-135(p.21-39))

An extensive study of diamond conduction counters has led to a fairly well established understanding of why some diamonds count and others do not. Irradiation with ultraviolet light has been shown to improve the counting abilities of some diamonds markedly. A circuit diagram is shown of a preamplifier built for use in conjunction with a chain of wide-band amplifiers in the diamond counter circuit. By using a cathode follower and exercising care in construction, the preamplifier was found to match the diamond to the amplifier, retain the requisite bandwidth, and have reasonably good gain. Polarization effects and secondary conduction, decay of space charge field, absorption spectra of counting diamonds, proportional counting, and thermal effects are discussed concerning diamond conduction counters. Crystals of sodium wolfram bronze have been grown and measurements made of the physical properties. Results are given of measurements of the electrical conductivity, Hall coefficient, density of charge carriers, magnetic susceptibility, electron mobility and mean free path, and thermal conductivity and electronic specific heat. A brief description is given of an apparatus for growing single crystals of metals with melting points as high as 2000°C and for studying the properties of solids at high temperatures.

3990

Raytheon Manufacturing Co.
SUMMARY TECHNICAL REPORT FOR THE PERIOD FEBRUARY 27, 1950, TO FEBRUARY 28, 1951. L. T. Jansen. Feb. 28, 1951. 27p. (NYO-1552)

Objectives, specifications, and manufacturing methods are presented for three subminiature tubes to be used in a Geiger counter for civilian defense use. Two of these are high-intensity $\gamma$-ray counter tubes, type QF-772 for 5 r/hr and type QF-783 for 500 r/hr. A constant operating voltage for the counter tube is provided by a corona-discharge-type voltage regulator tube, the QF-771.

3991

Commissariat à l' Énergie Atomique
CHARACTERISTIC PROPERTIES OF CRYSTALS; THEIR DEMONSTRATION. Christiane LeSueur. March 1951. 27p. (CEA-69)

The characteristic properties of scintillation crystals discussed are the photon spectrum emitted by passage of a particle, number of these photons, transparence of the

crystal to its own fluorescence radiation, and decay period of the fluorescence. The experimental apparatus, consisting of photomultiplier tube, preamplifier, amplifier, discriminator, and scaler, is described, and the experimental evaluation of the characteristic properties is discussed. Results of tests on various crystals with $\alpha$ and $\beta$ rays are reported graphically.

3992

AN EXTERNAL CATHODE HARD-GLASS GEIGER-MÜLLER TUBE. M. Yasin, R. Ahmed, and P. S. Gill. Nature 167, 647(1951) Apr. 21. (Letter to the editor)

Brief report is made of the properties of a hard-glass external-cathode counter. Such counters were found to have plateaus extending from 1200 to more than 3000 volts with slope <0.4% per 100 volts. The dead time is of the order of $3 \times 10^{-4}$ sec.

3993

Polaroid Corp.
FURTHER DEVELOPMENT OF FILM-TYPE GAMMA-RAY DOSIMETERS; FINAL REPORT; PERIOD ENDING MARCH 31, 1951. William A. Shurcliff. [nd] 28p. (NP-3082)

Merits of film badges in general are discussed. Considerable improvement has been made in the design of the self-developing type film badge, plaques FB-5a and -6a, and in the film holder FB-5b. General design and operation of these units are discussed.

3994

INVESTIGATION OF PROPORTIONAL COUNTERS; trans. from Zhur. Tekh. Fiz. 20, No. 9, 1141-4(1950)) V. A. Trofimova. 1950. 2p. (NP-2282)

A digest rather than a complete translation of the original is presented. The dependence of the coefficient of gaseous amplification on the place of incidence of the ionizing particles in counters filled with various gases has been determined.

3995

NEW PHOTOGRAPHIC METHOD FOR NEUTRON-VELOCITY SPECTROGRAPHY. J. M. W. Milatz, P. M. Endt, and C. H. Paris. Physica 16, 537-44(1950) June.

In all methods hitherto used in electrical neutron-velocity spectrometry, the individual neutrons are counted either by a number of mechanical registers ("channel method") or photographically ("discrete photographic method"). The authors suggest that it may be advantageous to utilize the integrating properties of the photographic plate rather than to count neutrons individually. The timing apparatus developed is simple and cheap and combines a time of flight resolution equal to that of the channel spectrometers now in use, with the useful property (in common with the discrete photographic method) of obtaining the whole velocity spectrum in one exposure. (auth) This abstract appears also in Monthly Abstract Bull. (Eastman) 37, 13 (1951) Jan.

3996

ON A METHOD FOR MEASUREMENTS OF THE ABSORPTION OF A NEUTRON BEAM. G. Stiennon. Bull. soc. roy. sci. Liège 19, 550-60(1950) Dec. (In French)

A setup for rapid and precise determinations of cross sections for absorption of neutrons that form a beam of mixed-velocity particles is described. The instrument producing the beam is a neutron gun consisting of a Ra + Be source placed at the bottom of a cylindrical cavity in a paraffin-Cd-Pb block, while the detector is a $BF_3$-filled counter surrounded by paraffin and Cd.

3997

ON THE PROPAGATION OF THE DISCHARGE IN THE PROPORTIONAL COUNTER. Remziye Akpinar. Rev. faculté sci. univ. Istanbul 14A, 281-310(1949) Oct. (In German)

Problems of propagation of the discharge within a proportional counter filled with alcohol or air were studied in a voltage range covering the transition between the proportionality and the G-M stages. Both the formation of a discharge ring around the anode and its subsequent lateral spread were examined in a counter whose cathode was split into four semicylindrical segments. The so-called abnormal pulses, produced by $\alpha$ rays at high voltages are regarded as a kind of streamer discharge.

3998

RADIATION INSTRUMENT CATALOG. AEC Radiation Instruments Branch. Washington, D.C., Office of Technical Services, U. S. Dept. of Commerce, 1951.

This is a list of 543 specific items of equipment now commercially available in the United States, including Geiger counters, ionization chambers, scintillation counters, dosimeters, film badges, and so forth. Also listed are 32 instruments capable of measuring and distinguishing between the three principal types of radiation.

3999

Atomic Energy Project (Canada)
A SIMPLE RADIOMETER FOR THE MEASUREMENT OF HIGH INTENSITIES OF SOFT X-RAYS. H. G. Heal. Jan. 18, 1951. 6p. (CRC-468)

A thermocouple-type radiometer is described which has been employed in connection with experiments on the chemical decomposition of solids by x rays. With slight modifications this radiometer shows possibilities of offering itself to many uses mainly because of its dimensions which can be reduced almost without limit except as determined by the requirements for absorption of x rays.

## MESONS

4000

Radiation Lab., Univ. of California
SUMMARY OF THE RESEARCH PROGRESS MEETING OF

FEBRUARY 1, 1951. Bonnie E. Cushman. Feb. 14, 1951. 11p. (UCRL-1132)

Meson-to-proton mass ratios have been determined through an arrangement whereby the protons and the three types of mesons exposed the same photographic plate. The best value of the $\pi$ meson mass was found to be 277 $m_e$. The mass ratios of meson to proton are 0.1511 ± 0.0006 for $\pi^+$ and 0.1504 ± 0.0007 for $\pi^-$. An attempt has been made to determine the binding energy of the dineutron from the $\gamma$ spectrum observed from the capture of $\pi^-$ in deuterium according to the reaction $\pi^- + d \rightarrow 2n + \gamma$. Theoretical and experimental curves are shown. 7 figures.

4001

THE ABSORPTION OF SLOW $\pi^-$ MESONS IN DEUTERIUM. S. Tamor. Phys. Rev. 82, 38-43(1951) Apr. 1.

The possible mechanisms for absorption of $\pi^-$ mesons in deuterium are considered. A phenomenological treatment of the simple neutron absorption permits the calculation of the competition between the processes independently of the value of the $\pi^-$-nucleon coupling constant. It is found that various meson theories for the charged meson lead to markedly different predictions for the fraction of events leading to $\gamma$-ray emission. The results are compared with experiment and lead to the conclusion that the charged meson is either pseudoscalar or pseudovector. Comparison with the $\pi^0$:$\gamma$ ratio from the absorption in hydrogen indicates that if the charged meson is pseudoscalar the neutral meson is also pseudoscalar. (auth)

4002

MESON EFFECTS ON DEUTERIUM; trans. from Doklady Akad. Nauk S.S.S.R. 75, No. 5, 655-8(1950). M. Markov. 1950. 6p. (NP-2278)

The creation of neutral, scalar, and pseudoscalar mesons by capture of fast neutrons by protons, that is, deuterium formation, has been considered for various widths of the potential well and for the case when the potential well equals zero. Plots have been made showing the dependence of cross section on neutron energy.

4003

ON THE INTERACTION OF MESONS WITH THE ELECTROMAGNETIC FIELD. I. Toichiro Kinoshita. Progress Theoret. Phys. (Japan) 5, 473-88(1950) May-June.

Presentation is made of the covariant formulation of the meson theory and of the S-matrix method describing the scattering of mesons in general. This formulation is applied to determine the second-order dynamical reaction of the electromagnetic field to the mesonic charge-current. A detailed discussion is given of the problem of polarization of the mesonic vacuum.

4004

THE PRODUCTION OF MESONS IN PROTON-PROTON COLLISIONS. J. C. Gunn, E. A. Power, and B. F. Touschek. Phil. Mag. (7) 42, 523-36(1951) May.

A method of estimating the cross sections for meson production in proton-proton collisions near the threshold is outlined, together with detailed calculations for spin-zero meson fields under certain simplifying assumptions concerning the nuclear forces. It is found that, for the final continuous neutron-proton system, a low energy for the neutron-proton relative motion is favored; this, together with a large contribution from transitions to a final bound deuteron, leads to a meson spectrum well peaked at the highest allowed energies in agreement with recent experiments. While the total cross section is dependent more on the shape and size of the internucleon potential than on the meson type, the spectrum at a given angle and, more particularly, the angular distribution are critically dependent on the parity of the produced meson. Comparison with experiment favors scalar mesons. (auth)

## METEOROLOGY

4005

Brookhaven National Lab.
AN ALL-WEATHER, REMOTE-RECORDING BIVANE. Daniel A. Mazzarella. [nd] 20p. (AECU-1243)

The need for continuous measurements of the horizontal and vertical components of eddy motion on the 420-ft Brookhaven meteorology tower has resulted in the construction of an all-weather, remote-recording bivane. The instrument is designed primarily for measuring long-period gusts. Characteristics of the instrument as determined in wind-tunnel tests are discussed in detail. Comparisons are made between bivane traces and standard-vane traces. The findings of almost a year of operation on the Brookhaven meteorology tower are examined and compared with the results available on other bivanes. The usefulness of this instrument as an indicator of smoke behavior is discussed. (auth)

4006

Electrical Engineering Research Lab., Univ. of Texas
FINAL REPORT ON THE MICROMETEOROLOGICAL RESEARCH CONDUCTED UNDER OFFICE OF NAVAL RESEARCH CONTRACT N6onr-266, T. O. II. J. R. Gerhardt, K. H. Jehn, and R. C. Staley. Sept. 30, 1950. 39p. (NP-1988)

Research accomplishments are summarized. Previously un unpublished phases of the research concerning site description, tower instrumentation, and data reliability are reported in detail. The performance of thermistors for the measurement of air temperature is critically evaluated, and a preliminary study investigates the possibility of their use for the measurement of wind speed. Recommendations for further studies are suggested. (auth)

## MICROWAVES

4007

Columbia Radiation Lab.
QUARTERLY REPORT; [SECOND] FOR THE FISICAL YEAR 1950-51. Dec. 31, 1950. 52p. (NP-3034)

Several methods of improving magnetron cathode centering have been investigated. The assembly and testing of several new magnetrons have been accomplished. Main cathode materials and significant geometrical parameters are tabulated for AX9-23.2E and -28.1E and AD9-1E, -3E, -4E, -6E, -8E, -9E, -10E, and -11E tubes. Operating characteristic curves are shown and discussed. Operating procedures are discussed for a newly completed mechanical spectrum analyzer, and a block diagram of the circuit is shown. Results of preliminary tests made on a millimeter harmonic generator containing Ge and Si crystals, using incident radiation of 1.25-cm wavelength from a K33 klystron, are tabulated. Details are given of the modification of the microwave Fabry-Perot interferometer for laboratory use. Apparatus for use in preliminary measurements of ionized-He fine structure is described. The interaction space, detection apparatus, and time sequence are discussed, and schematic diagrams are shown of the central timing control and vacuum system. A search for the microwave spectrum of the free radical OH is discussed, and data are presented. Results obtained in the observation of the microwave spectrum of $O_2$ in the region 28,000 to 60,000 Mc indicate the spin of $O^{16}$ to be zero.

## NUCLEAR PROPERTIES

4008

Argonne National Lab.
RELATIVE MASSES OF THE 4n + 1 RADIOACTIVE SERIES. J. R. Huizenga, L. B. Magnusson, O. C. Simpson, and G. H. Winslow. Mar. 30, 1951. Decl. May 11, 1951. 14p. (AECD-3150; ANL-WMM-820)

Studies have been made of the energy cycles involving the $\alpha$ and $\beta^-$ disintegration energies of the 4n + 1 and the 4n + 2 radioactive series and neutron binding energies of $Pb^{210}$ and $U^{238}$. Single and double binding energies in the radioactive series 4n, 4n + 1, 4n + 2, and 4n + 3, were calculated. Results have been tabulated and compared with the results of others. 6 references.

4009

Columbia Univ.
NEUTRON VELOCITY SPECTROMETER TRANSMISSION MEASUREMENTS, sect. I of PROGRESS REPORT; [SECOND QUARTERLY PROGRESS REPORT FOR FISCAL YEAR 1950-1951]; NUCLEAR PHYSICS LABORATORIES. J. R. Dunning, Director. Dec. 31, 1950. 9p. (CUD-65(sect. I); DR-1578)

The principal resonance energies of Au and Ag have been redetermined using more accurate timing corrections than heretofore. Results are: Au, $E_0 = 4.93 \pm 0.07$ ev; Ag, $E_0 = 5.20 \pm 0.07$ ev. Fe has been reinvestigated in the high-energy region, but small impurity resonances preclude accurate interpretation of results. Recent redetermination of the principal Co resonance energy yields $E_0 = 130 \pm 5$ ev with $\sigma_0 \Gamma^2 = 2.5 \times 10^5$ barn $(ev)^2$, which when combined with Seidel's result, $\sigma_0 = 12{,}500 \pm 1250$ barns, yields for the level: $\Gamma = 5.3$ ev; I = 3. One or more levels in the vicinity of 8000 ev have also been observed. Changes in shape and position of the dee "feeler" electrodes have produced increased cyclotron intensity and faster arc cutoff. A new low-temperature sample holder to be used in inelastic scattering measurements has been designed and construction started. The p-$H_3$ analysis system has been more critically tested. Transmission studies indicate a strong Te resonance at 2.1 ev and smaller ones at 7.2, 20, 60, and 375 ev. An enriched sample of $Te^{124}$ shows all the resonances except that at 375 ev. Measurements on the 2.1-ev resonance are being continued so that $\sigma_0$ and I can be determined. Both the counting rate and the signal-to-noise ratio have been improved in the system for detecting resonances by measuring capture $\gamma$ rays. Fractional absorption calculations agree with transmission measurements although accuracy is still poor. 6 figures. (auth)

4010

Oak Ridge National Lab.
INVESTIGATION OF NUCLEAR EFFECTS IN PARAMAGNETIC SINGLE CRYSTALS AT VERY LOW TEMPERATURES. Stephen F. Malaker. May 8, 1951. 41p. (ORNL-993)

The hyperfine structure coupling of the magnetic moment of the nucleus with the magnetic moment of the electronic cloud of a paramagnetic ion gives rise to a Schottky specific heat anomaly at an appropriate temperature. For the cobaltous ion in a single crystal of cobalt ammonium sulfate this temperature is about 0.1°K. In the region where the specific heat goes as $A/T^2$ and where the Curie Law $\chi = C/T$ holds, measurements can be made of A by means of an a-c mutual inductance bridge which measures the susceptibility of the paramagnetic salt. The method of measurement consists in superposing a d-c magnetic field on the salt already in the a-c field of the bridge. This d-c field depresses the susceptibility an amount depending on the parameter C/A which is therefore a constant of the material being investigated. If the Curie constant is known, then A is given immediately. This measured A, however, is made up of two contributions: (a) that arising from the nuclear-electronic coupling, and (b) that arising from the dipole interaction of neighboring paramagnetic ions. The (b) contribution is a function of concentration of the ions, so that by making measurements of A at various dilutions and plotting A as a function of dilution an intercept is obtained by extrapolation to infinite dilution which is the part of A due to nuclear specific heat. The thermodynamic measurements made thus give a nuclear specific heat of $C_v T^2 = 16.1 \times 10^{-4}$ R, where R is the gas constant, which is in excellent agreement with $C_v T^2 = 16 \times 10^{-4}$ R calculated from microwave data. It is observed that pure cobalt ammonium sulfate has a Curie point at ~0.125°K, while the diluted salts do not possess one in the same temperature region. (auth)

4011

THE DEUTERON QUADRUPOLE MOMENT AND THE RADIOFREQUENCY SPECTRA OF $H_2$ AND $D_2$ IN LOW MAGNETIC FIELDS. H. G. Kolsky, T. E. Phipps, Jr., N. F. Ramsey, and H. B. Silsbee. Phys. Rev. 81, 1061(1951) Mar. 15. (Letter to the editor)

A molecular-beam apparatus of high resolution has been used to study the r-f spectra of $H_2$ and $D_2$ in magnetic fields between 1 and 9 gauss. The observed transitions correspond to (F,m) = (0,0) — (1,1) for $D_2$ and (0,0) — (1, ±1) for $H_2$. From the calculated values obtained and from

Newell's theoretical value for q (Phys. Rev. 78, 711(1950)), the deuteron quadrupole moment is calculated to be: $Q = (2.738 \pm 0.016) \times 10^{-27}$ cm$^2$.

4012

THE FIRST EXCITED STATE OF $Be^7$ FROM THE $Li^7(p,n)Be^7$ REACTION. Harvey B. Willard and William M. Preston. Phys. Rev. 81, 480-1(1951) Feb. 1. (Letter to the editor)

A brief note is presented in regard to the detection of a low-energy neutron group with a measured threshold at 2.38 Mev. A thin Li target was bombarded with protons from the Massachusetts Institute of Technology electrostatic generator. A plot of the ratio of the counts obtained from a bare $BF_3$ counter to those from a paraffin-moderated "long counter" shows the threshold to be 2.378 Mev and the Q value to be 2.081 Mev.

4013

NUCLEAR DATA. SUPPLEMENT 1 (JANUARY TO JULY 1950) TO NBS CIRCULAR 499. Natl. Bur. Standards, Washington, D. C., Government Printing Office, 1951. 56p.

Data sheets designed for easy insertion into the original volume are presented. New data on half lives, radiations, nuclear moments, cross sections, etc., on the known nuclides are presented in the tabular style of the original. New types of data included, and to be reported in future supplements, are nuclear scattering lengths, packing fractions and mass differences, notes on isotope shifts, ranges of $\alpha$ particles in photographic emulsions, and information on nuclear reactions in the light elements, $Z \leq 20$. Information about fission and spallation processes has been omitted.

## NUCLEAR REACTORS

4014

NEUTRON DIFFUSION AND THE THEORY OF THE ATOMIC PILE. André Ertaud. Vide, Le 6, 966-73(1951) Mar. (In French)

An introductory discussion of problems of neutron deceleration and of the calculation of critical dimensions of nuclear reactors is presented.

## NUCLEAR TRANSFORMATION

4015

Wisconsin Univ.
ELASTICALLY SCATTERED PROTONS FROM CARBON. Gerson Goldhaber and R. M. Williamson. [nd] 15p. (AECU-1338)

An abstract of this report was issued and indexed as report AECU-1041 and appeared in Nuclear Science Abstracts as NSA 5-876.

4016

Radiation Lab., Univ. of California
GAMMA RAY SPECTRUM FROM THE ABSORPTION OF NEGATIVE PI MESONS IN DEUTERIUM. (thesis) R. Lee Aamodt. Mar. 1, 1951. 54p. (UCRL-1151)

A summary is made of established data obtained on the characteristics of mesons in previous experiments. An extension has been made of the H capture experiment investigating three reactions: $\pi^- + d \rightarrow 2n + \gamma$; $\pi^- + d \rightarrow 2n + \pi^- \rightarrow 2n + 2\gamma$; $\pi^- + d \rightarrow 2n$. Discussions are given of the variation in the number of mesons stopped in deuterium as a function of wall thickness of the pressure vessel, the effect of scattering of the electron pair on the spectrometer characteristics, the effect of radiation straggling of the electron pair on the measured energy of the pair, the resolving power of the spectrometer due to finite channel width, and the calculation of the f factor. 20 references.

4017

ANGULAR YIELD OF DEUTERONS AND ALPHAS FROM THE PROTON BOMBARDMENT OF BERYLLIUM. J. A. Neuendorffer, D. R. Inglis, and S. S. Hanna. Phys. Rev. 82, 75-80(1951) Apr. 1.

A photographic target chamber incorporating limited magnetic deflection of product particles was used to measure the angular yield of deuterons and $\alpha$ particles from the proton bombardment of Be at energies up to 1 Mev. The angular variation observed is of the form $1 + A_1 \cos\theta + A_2 \cos^2\theta$, with relatively large values for $A_1$ indicating strong interference between states of the compound nucleus of opposite parity. The variation of the total cross sections with energy suggests the presence of a state of the compound nucleus at $E_p = 0.68$ Mev, in addition to the states previously known at $E_p = 0.33$ and 0.94 Mev. Range in emulsion versus energy measurements for the light nuclei observed in the reaction are also given. (auth)

4018

THE ANNIHILATION OF POSITRONS. PART I. Süreyya Meric. Rev. faculté sci. univ. Istanbul 15A, 136-62(1950) Apr.

The angular distribution of the annihilation radiation in two-quanta annihilations was studied with a view of finding evidence of the existence of annihilations of particles in motion; no definite results were obtained. Other experiments concerned the rarer processes of annihilations resulting in the creation of a single quantum; such radiations, with an energy exceeding 1 Mev, were observed.

4019

Commissariat à l'Énergie Atomique
ATTEMPT AT A DEMONSTRATION OF A Fe (n,$\alpha$) REACTION PRODUCED BY SLOW NEUTRONS; extract from Compt. rend. 231, 1475-6(1950). Henriette Faraggi. Dec. 18, 1950. 2p.

An abstract of this report appeared in Nuclear Science Abstracts as NSA 5-2912.

4020

THE CROSS SECTION RATIO $\sigma[B^{10}(n,\alpha)Li^7]/\sigma[B^{10}(n,\alpha)Li^{7*}]$ AS A FUNCTION OF ENERGY. H. Bichsel, W. Hälg, P.

Huber, and A. Stebler. Phys. Rev. 81, 456-7(1951) Feb. 1. (Letter to the editor)

A brief note is presented on the ratio of the cross sections, $K = \sigma[B^{10}(n,\alpha)Li^{7}]/\sigma[B^{10}(n,\alpha)Li^{7*}]$, measured for thermal neutrons and neutrons with 0.5, 1.9, 2.9, 3.5, and 3.9-Mev energy. The measured values obtained are presented graphically.

4021

George Holt Physics Lab., Liverpool (England)
NEUTRONS FROM SPONTANEOUS FISSION. J. Rotblat. Apr. 26, 1951. 6p. (BR-241)

The process of spontaneous fission of U has been investigated. By observing the activity induced in a detector, the emission of neutrons accompanying spontaneous fission of U has been established. The number of neutrons from spontaneous fission has been determined to be $21 \pm 4$/sec/kg of $U_3O_8$, or $2.6 \pm 0.5$ neutrons/fission.

## PARTICLE ACCELERATORS

4022

Case Inst. of Tech.
NUCLEAR PHYSICS PROGRAM OF THE DEPARTMENT OF PHYSICS; PROGRESS REPORT; JANUARY 1, 1949, TO NOVEMBER 1, 1949. [nd] 18p. (AECU-1159)

Several improvements have been made in the betatron which permit greater operating efficiency and usefulness of the machine. These include improved magnetic measurements, conducting coatings on the inside of the vacuum donut, electron gun, and vacuum system, and a method of removing the electron beam from the donut. A device for analyzing the spectrum of a $\gamma$ or x-ray source is described in some detail. The statuses of other phases of this program are discussed briefly. Appendixed to this report are two reprints: Production of $\pi$-Mesons in Nucleon-Nucleon Collisions, L. L. Foldy and R. E. Marshak, Phys. Rev. 75, 1493-9(1949) May 15 (NSA 3-129); and Single Production of Mesons by Gamma Rays Near Threshold, L. L. Foldy, ibid. 76, 372-4(1949) Aug. 1 (NSA 3-1380).

4023

Princeton Univ.
ON DEFLECTION AT n = 1 IN THE SYNCHROCYCLOTRON. D. R. Hamilton and H. J. Lipkin. Sept. 1, 1950. 41p. (NYO-781)

The theory of a possible method of synchrocyclotron beam deflection in which the orbits expand until the point of maximum Hr (n = 1) is reached, after which the ions escape and spiral outward, is discussed. These spirals should have a uniform starting radius and a small pitch in order to give deflection efficiency of the order of 100%; it is shown that this requires a flat maximum of Hr at n = 1, and small amplitude of radial oscillation. The radial and vertical oscillations of the beam and the couplings thereof are discussed in detail. It appears that the only field inhomogeneities which must be carefully minimized are those at n = 1 and n = 0. Limits on radial and vertical oscillations in the immediate vicinity of the ion source are set, but the origins thereof in phenomena other than field inhomogeneity are not discussed. (auth)

4024

Radiation Lab., Univ. of California
LINEAR ACCELERATOR BEAM DYNAMICS. Wolfgang K. H. Panofsky. Feb. 1951. 20p. (UCRL-1216)

General equations of motion of a charged particle, basic geometry of the linear accelerator, synchronous conditions, types of stability for a "long" accelerator, the "incompatibility" theorem, velocity focusing, radial oscillations, phase oscillations, large oscillations, and unstable operation are treated.

4025

Nevis Cyclotron Labs., Columbia Univ.
CYCLOTRON REPORT; 1950-1951. E. T. Booth, M. W. Johnson, R. W. Schubert, H. C. Beck, W. E. Hovemeyer, and W. F. Goodell, Jr. Mar. 30, 1950. 52p. (NP-3045)

The Nevis cyclotron has been constructed and placed in operation. It is producing protons of the designed energy of 385 Mev. This report is made up of four sections. The first gives actual details of construction. The site and building, magnet, vacuum system, r-f system, auxiliary equipment, electrical system, and shielding are discussed and illustrated. This section is followed by a report of the performance of the cyclotron, a program of instrument construction, and an outline of a research program which is to be undertaken during the fiscal year 1950-1951. 31 figures.

4026

THE 800-KV. NEUTRON GENERATOR OF THE UNIVERSITY OF ISTANBUL. Fahir E. Yenicay. Nature 167, 765(1951) May 12.

Brief note is made of the Philips neutron generator of 800/650 kv installed October 1950 for nuclear research purposes at the University of Istanbul. The apparatus provides target currents of ~170 $\mu$a (protons or deuterons) at a voltage of 650 kv.

## RADIATION ABSORPTION AND SCATTERING

4027

Oak Ridge National Lab.
COHERENT AND TOTAL SCATTERING CROSS SECTIONS OF URANIUM AND THORIUM. C. G. Shull and E. O. Wollan. [nd] 1p. (AECD-3136)

The report is reproduced here in its entirety.

The neutron-diffraction technique has been applied to the study of a number of crystal compounds containing U and Th. These studies have been made primarily for the purpose of determining parameters associated with the location of light elements (C, D, H, Al, O, etc.) within the unit cells of the crystals. In these studies the coherent and total scattering cross sections for U and Th also have been determined. These cross sections are necessary information in the analysis of the structures of U and Th containing crystalline compounds, and reporting of the crystal structure information depends on the free use of all the relevant scattering cross sections. The average cross sections obtained by measurements on a number of U and Th compounds are given by the following table.

Scattering Cross Sections

| | $\sigma_{coh}$ | $\sigma_{tot}$ |
|---|---|---|
| U (normal) | 9.0 barns | 9.0 barns |
| Th | 12.8 barns | 12.8 barns |

4028

Los Alamos Scientific Lab.
COMPARISON OF DATA ON THE SCATTERING CROSS SECTIONS OF CARBON AND HYDROGEN. G. F. Chew. Mar. 14, 1944. Decl. Apr. 19, 1951. 3p. (AECD-3157; LADC-918)

A graphical comparison is made of British data by Bretscher and Murrell, compiled from BM-62, with the standard data used at Los Alamos, obtained by Wi'liams at Minnesota and recorded in CF-599. The British values for neutron scattering by H scatter somewhat more than the American but are generally in good agreement. William's data on C are considerably more detailed than those of Bretscher and Murrell and show maxima not revealed by the latter. (auth)

4029

Columbia Univ.
NEUTRON SCATTERING EXPERIMENTS, sect. II of PROGRESS REPORT; [SECOND QUARTERLY PROGRESS REPORT FOR FISCAL YEAR 1950-1951]; NUCLEAR PHYSICS LABORATORIES. J. R. Dunning, Director. Dec. 31, 1950. 5p. CUD-65(sect.II); DR-1578)

A complete description of the experimental apparatus and method for measurement of $(\sigma_s/\sigma_t)(E)$ and final results on Au has been written (CUD-64). Weak levels (or groups) in Au have been observed at ~75 ev and ~300 ev. Comparison with transmission studies in the same region shows much higher sensitivity for the thick-target scattering detection of weak levels which are due principally to capture. Incomplete results on the Ag 5.2-ev resonance indicate a tentative value $\Gamma_N/\Gamma \approx 0.14$. Scattering measurements on the 16-ev level and ~45-ev group indicate that they are predominantly capture levels. An apparatus for determination of cross sections for self-indication has been designed and built for use in conjunction with the $(\sigma_s/\sigma_t)$ experiments. Apparatus calibration for the forward scattering experiment, using a V scatterer, has been completed and checked against polythene with good agreement. Scattering data from MnO and $MnF_2$ at below room temperature have been taken and are in process of analysis. The incoherent scattering cross section of Te, corrected for multiple scattering, has been found to be 0.6 ± 0.2 barns. (auth)

4030

DETERMINATION OF EFFECTIVE CROSS SECTIONS FOR THERMAL NEUTRONS; PART II. Georges Guebén. Bull. soc. roy. sci. Liège 19, 525-38(1950) Dec. (In French)

A setup for the measurement of cross sections for thermal-neutron capture, which has been described in Part I (Bull. soc. roy. sci. Liège 19, 456(1950)), was tested using the following materials as absorbers: Pb, Zn, Cu, Ni, Mn, S, P, $U_3O_8$, U, Rh, Ag, Au, Ir, ZnS, PbS, CuS, and NiS. Although generally satisfactory, the results differ in many cases from those reported by other writers. Furthermore, a notable dependence of the results on the material used as a detector (Ag, Dy, Rh, In, or Mn) was observed.

4031

MAGNETIC STRUCTURE OF MAGNETITE AND ITS USE IN STUDYING THE NEUTRON MAGNETIC INTERACTION. C. G. Shull, E. O. Wollan, and W. A. Strauser. Phys. Rev. 81, 483-4(1951) Feb. 1. (Letter to the editor)

The magnetic structure of $Fe_3O_4$ has been determined through a study of its magnetic scattering properties. The study also revealed that its magnetic properties make it favorable for use in studying the directional properties associated with the magnetic scattering of neutrons. Neutron-diffraction studies made on several samples of $Fe_3O_4$ show a (111) reflection which arises almost wholly from magnetic scattering with only about 2% nuclear scattering contribution. The (111) powder diffraction ring was investigated when the sample was magnetized in different direction, $\alpha$ = 90 to 0°, with the results that, at $\alpha$ = 90°, the intensity was increased over that of the unmagnetized sample, and when $\alpha$ = 0°, the intensity falls to a very low value.

4032

THE THEORY OF RESONANCE SCATTERING OF PARTICLES; trans. from Zhur. Eksptl'. i Teoret. Fiz. 18, No. 7 (1948). A. Akhiezer and I. Pomeranchuk. 1948. 7p.

This report is a translation from the Russian of the original article which was abstracted in Nuclear Science Abstracts as NSA 1-1639.

RADIATION EFFECTS

4033

Purdue Univ.
BASIC RADIATION DAMAGE STUDIES WITH CHARGED PARTICLES FROM THE PURDUE CYCLOTRON. Mar. 1, 1951. 11p. (AECU-1277)

The scope of investigations planned or in progress on physical changes in solids exposed to cyclotron radiation is discussed. Because it is possible to produce comparatively high fluxes in a well-defined area by the use of deuteron and $\alpha$ particles, investigations have been started on those effects in semiconductors which lead to the application of semiconductors as fluxmeters as well as to the discovery of new properties of the solid and also on the changes in the thermal, mechanical, and electrical properties of the metals.

4034

Atomic Energy Project, Univ. of California, Los Angeles
THE PRODUCTION OF ULTRA-VIOLET RADIATION IN DISTILLED WATER EXPOSED TO THE GAMMA RAYS OF RADIUM. M. A. Greenfield, A. H. Dowdy, and P. M. Kratz. Apr. 23, 1951. 9p. (UCLA-127)

The possibility of ultraviolet fluorescence of water exposed to $\gamma$ radiation has been investigated. Experimental techniques

and arrangements are described. Results indicate that ultraviolet radiation is produced in these circumstances.

## RADIOACTIVITY

4035

Los Alamos Scientific Lab.
SPONTANEOUS FISSION. Emilio Segrè. [nd] Decl. May 8, 1951. (AECD-3149; LADC-975)

A summary is made of spontaneous fission work done at this project up to January 1, 1946. Apparatus and experimental techniques which were used to measure the spontaneous fission decay constants and the number of neutrons emitted per fission of $Ra^{226}$, Io($Th^{230}$), $Th^{232}$, $Pa^{231}$, $U^{232}$, $U^{233}$, $U^{234}$, $U^{235}$, $U^{238}$, $Np^{237}$, $Np^{239}$, $Pu^{238}$, $Pu^{239}$, and $Am^{241}$ are described in detail. Results of these measurements are tabulated.

4036

Ames Lab.
A 25-DAY ACTIVITY IN $P^{32}$ SAMPLES. (Contribution No. 140). Erling N. Jensen and R. T. Nichols. Apr. 5, 1951. 4p. (AECU-1264)

The $\beta$ spectra of samples of $P^{32}$ up to 10 months old have been determined with a thin-lens $\beta$-ray spectrometer. The presence of a low-energy $\beta$ group of 25.2 ± 0.5-day half life and 0.26 ± 0.02-Mev maximum energy was demonstrated. It is estimated that the 25-day activity formed about 1% of the initial activity of the sample.

4037

Columbia Univ.
LIGHT PARTICLE INVESTIGATIONS, sect. VI of PROGRESS REPORT; [SECOND QUARTERLY PROGRESS REPORT FOR FISCAL YEAR 1950-1951]; NUCLEAR PHYSICS LABORATORIES. J. R. Dunning, Director. Dec. 31, 1950. 7p. (CUD-65(sect. VI); DR-1578)

Preliminary investigations on $P^{32}$ using thin evaporated sources show the same low-energy electron excess previously reported. A search for a $P^{32}$ $\gamma$ ray yielded negative results. An analysis of the spectrum of $Tc^{99}$ is being made in an attempt to determine which of the five relativistically invariant interaction forms is in best agreement with the data. The $\beta$ spectrum of $Cl^{36}$ is being reinvestigated with special emphasis on the region below 200 kev, using a low background system and thinner and more uniform sources than heretofore. Changes in the apparatus for the $\beta$-$\gamma$ angular correlation experiment have been made so that coincidences are counted only when the participating $\beta$ particle has a specific energy. Also the brass vacuum chamber has been replaced by one of lucite in order to reduce scattering. $\beta$-$\gamma$ coincidence results on $Sb^{122}$ yield $R/Q = +0.067 \pm 0.01$, accepting $\beta$ rays of all energies and assuming a distribution $W(\theta) = 1 + (R/Q)\cos^2\theta$. Using $\beta$ rays between 1.00 and 1.36 Mev yields a differential correlation coefficient $R/Q = 0.157 \pm 0.02$. Preliminary results on $Nb^{95}$ indicate strong negative correlation. The possibility of using powdered Be metal for the $He^6$ source in the neutrino experiment has been investigated. Results indicate that $Be(OH)_2$ is far superior to the powdered Be metal. An anthracene scintillation spectrometer operates better for $\beta$ detection than with NaI. An oscillographic method for measuring $\gamma$-ray energies versus time (for short timings) is in development. A search for $\gamma$ rays of energy > $mc^2$ in $O^{15}$, initiated because of an apparent curvature in the positron spectrum, has been made. An upper limit of 0.5% is set on the relative intensity of the high-energy radiation. These high-energy $\gamma$ rays can be ascribed entirely to fast-positron annihilation.

4038

Ames Lab.
RADIATION STUDIES, p.6-12 of PROGRESS REPORT IN PHYSICS FOR THE PERIOD JULY 1, 1950, TO DECEMBER 31, 1950. G. W. Fox, W. C. Caldwell, J. F. Carlson, G. C. Danielson, E. N. Jensen, J. K. Knipp, J. M. Keller, L. J. Laslett, S. Legvold, G. Miller, and D. Zaffarano. Mar. 15, 1951. 7p. (ISC-135(p.6-12))

An upper limit of approximately 0.67 Mev has been obtained for the low energy $Rb^{86}$ $\beta$ ray using a coincidence scintillation spectrometer. An investigation of the $\beta$ spectra of $Ag^{112}$ and $Ag^{113}$ was carried out with the radio-Ag produced by the synchroton irradiation of $Cd(NO_3)_2$. Half lives of 3.2 and 5.3 hr were found for $Ag^{112}$ and $Ag^{113}$, respectively, with upper limits of 4.2 and 2.0 Mev for these respective activities. A weak low energy $\beta$ component, having a maximum energy of about 0.3 Mev and half life of about 26 days, has been observed in the $\beta$ spectrum of $P^{32}$. The energy of the $Cs^{137}$ $\gamma$ ray has been measured with a thin lens spectrometer, and found to be 0.6605 ± 0.001 Mev. A cylindrical proportional counter has been used to obtain $\beta$ spectra from radioactive samples. The results for a $Te^{125}$ sample are shown. The amplified pulses from electron energies of 104, 78, and 30 kev have been displayed on an oscilliscope and photographed.

4039

Oak Ridge National Lab.
SHORT-LIVED ISOMERIC STATES OF NUCLEI. Francis K. McGowan. Mar. 13, 1951. 134p. (ORNL-952)

The extension of the method of delayed coincidences between scintillation detectors to measure shorter time intervals and the systematic search for the occurrence of nuclear excited states decaying with half lives between $5 \times 10^{-9}$ and $10^{-4}$ sec are summarized. During the course of the survey a delayed-coincidence scintillation spectrometer was developed. This instrument increased the sensitivity of the method and permitted a measure of the energy and type of radiation announcing the formation of an isomeric state, the energy of the radiation following the decay of a metastable state, the ratio of K- to L-shell internal conversion of $\gamma$ rays, and the position of the isomeric state in the disintegration scheme. A general discussion of all the short-lived isomers of nuclei observed to date is given, and all data are collected. A comparison of experimental lifetimes with the predicted estimates, a prevalence of short-lived isomers in odd-mass nuclei with Z odd, and a correlation of the negative results with nuclear shell structure is presented.

4040

Radiation Lab., Univ. of California
THE SPECIFIC ALPHA ACTIVITY OF $U^{235}$. E. H. Fleming,

Jr., A. Ghiorso, and B. B. Cunningham. Mar. 2, 1951. 2p. (UCRL-1161)

The report is reproduced here in its entirety.

The half life of $U^{235}$ has been the subject of several recent experimental investigations. Clark, Spencer-Palmer, and Woodward (Imperial Chemical Industries Limited Report BR-522, Oct. 10, 1944) reported a value of $8.91 \times 10^8$ yr, derived from their $\alpha$ pulse analyses of natural and enriched mixtures of $U^{238}$, $U^{235}$, and $U^{234}$. Kienberger (Phys. Rev. 76, 1561(1949)), after remeasuring the specific activity and $U^{234}$ content of normal U, computed the specific activity of $U^{235}$ by difference and obtained a half life of $(8.8 \pm 1.1) \times 10^8$ yr. All these values are substantially higher than Nier's (Phys. Rev. 55, 150(1939); ibid. 153(1939)) figure of $7.13 \times 10^8$ yr. Because of the rather wide divergence among these various values, and also because of the general interest in the exact value of the $U^{235}$ half life, which enters into the computation of geological time, we have carried out several measurements of the specific $\alpha$ activity of $U^{235}$ in this laboratory. The U used for this purpose was highly purified (99.9%) $U^{235}$, supplied to us as $U_3O_8$ from Dr. C. E. Larson, Y-12 Plant, Carbide and Carbon Chemicals Division, Oak Ridge National Laboratory. Careful spectrographic analysis established that the chemical purity of this material was better than 99.95%. Differential pulse analysis showed that $65.3 \pm 0.7\%$ of the $\alpha$ activity was due to $U^{235}$, and $34.7 \pm 0.3\%$ to $U^{234}$. The details of this measurement are contained in another publication by Ghiorso ("$U^{235}$ Alpha Fine Structure," Phys. Rev., in press). Samples of the oxide were weighed to $\pm 0.1\%$, and were then dissolved in concentrated $HNO_3$ and diluted to volume. Accurate volume aliquots of these solutions were taken, and the U was electrodeposited quantitatively onto Pt disks. Thin, uniform films resulted, of the order of 100 to 200 mg/cm$^2$. The highly enriched $U^{235}$ depositions were counted in a specially constructed, He-filled, medium-geometry counter (counting yield $8.313 \pm 0.016\%$) which was calibrated with mixtures of $U^{238}$ and $U^{234}$ against a low geometry counter of accurately known counting yield. We believe that use of the medium geometry counter for the $U^{235}$ samples reduced to negligible magnitude any errors arising from backscattering or self-absorption, since analysis of the pulses from this chamber showed an extremely flat plateau. The specific activity of $U^{235}$, as determined from five separate $U^{235}$ depositions, was found to be $4774 \pm 72$ disintegrations/min/mg with a corresponding decay constant of $(9.80 \pm 0.15) \times 10^{-10}$/yr and a corresponding half life of $(7.07 \pm 0.11) \times 10^8$ yr. Our value for the half life agrees closely with the $7.13 \times 10^8$ yr value reported by Nier. The value reported by Clark and coworkers, $8.91 \times 10^8$ yr, differs from ours by about 25%. A partial explanation lies in the fact that these workers were unable to detect the high- and low-energy $\alpha$ groups (Ghiorso, loc. cit.) comprising about 15% of the total disintegrations from $U^{235}$, in their pulse analysis of slightly enriched $U^{235}$ samples. However, it is difficult to account for the other 10% discrepancy. A more precise value and a detailed description of this work is to be reported at a later date.

4041

DETERMINATION OF ENERGY DISTRIBUTION IN BETA SPECTRA FROM ABSORPTION MEASUREMENTS. Herwig Schopper. Z. Physik 129, 416-25(1951) Apr. 2. (In German)

A new method for the calculation of energy distributions in $\beta$ spectra by using absorption data is given. Whereas in other methods the absorption law for homogeneous electrons is described by a linear function, a closer approximation is reached here by means of a parabolic function; the maximum of the energy distribution curve, which in older methods was always shifted toward higher energies, is here very close to its real value. Another advantage of the proposed procedure is the possibility of obtaining a finite number of zero-energy particles, whereas in all other methods the energy-distribution curve must begin with the ordinate zero. By using a special analytical treatment of the absorption curve for large absorbing thicknesses, the method is applied to a number of experimentally found absorption curves, and the energy distributions so obtained are compared with direct spectrometric data. (auth)

4042

EVIDENCE FOR THE NATURAL RADIOACTIVITY OF INDIUM. S. G. Cohen. Nature 167, 779(1951) May 12. (Letter to the editor)

Radioactivity of $In^{113}$ and $In^{115}$ has been confirmed. When In cathodes were used in Geiger counters, an increase in counting rate above background was detected. An attempt was made to identify the radiation. $In^{115}$ apparently decays by $\beta$ emission to $Sn^{115}$ with a half life $\sim 10^{14}$ yr. Inconclusive results suggest that a small part of the radiation may consist of L-capture x rays in the decay (half life $\sim 10^{12}$ yr) of $In^{113}$ to $Cd^{113}$.

4043

THE ISOMERIC STATE OF RaE. N. Feather. Phil. Mag. (7) 42, 568-70(1951) May. (Correspondence)

Following a general discussion of known phenomena, difficulties regarding the assumption that the $\alpha$ disintegration of RaE* ($Bi^{210m}$) is to the ground state of $Tl^{206}$ are considered. Three possibilities are listed: (1) the lifetime of RaE* for $\alpha$ emission may in fact be of the order of $10^5$ to $10^6$ yr; (2) the $\beta$ disintegration of RaE* may be to an isomeric state of $Tl^{206}$; and (3) the $\alpha$ disintegration of RaE* may be abnormal in the sense that it violates the general regularities exhibited in the Geiger-Nuttall diagram.

4044

NEUTRON-INDUCED ISOMERS OF XENON: A NEW ISOMER OF XENON-129. Ingmar Bergström. Nature 167, 634-5(1951) Apr. 21.

In order to search for the metastable $Xe^{129}$, Xe was irradiated in the BEPO at Harwell. After irradiation the Xe activities were electromagnetically separated. Each odd mass number was separately investigated with the $\beta$ spectrometer. A new Xe activity of mass number 129 was discovered. The half life is $8.0 \pm 0.2$ days and the $\gamma$ energy of the isomeric transition $196 \pm 2$ kev. The intensity ratio of the K and L + M conversion electrons is about 2.1. No other conversion lines were found in the $Xe^{129}$ sample. Measurements by the authors indicate that the 30-day activity of $Xe^{127}$ is associated with the decay of the ground state of $Xe^{127}$, and that it decays mainly by K-capture to $I^{127}$. The activities of $Xe^{131}$ and $Xe^{133}$ are discussed briefly.

## SHIELDING

4045

Knolls Atomic Power Lab.
PHYSICAL PROPERTIES OF HIGH DENSITY CONCRETE. W. Blinder. Apr. 10, 1950. Decl. Apr. 23, 1951. 21p. (AECD-3139; KAPL-318)

Measurements on the compressive strength at room temperature, 300°F, and 500°F, density, heat of setting, modulus of elasticity, modulus of rupture, specific heat of cement, setting time, slump, and thermal conductivity of magnesium oxychloride cement as carried out at KAPL are summarized and compared with results from ORNL and Battelle. Specifications for MO concrete are recommended tentatively.

## THEORETICAL PHYSICS

4046

A CANONICAL TRANSFORMATION IN THE THEORY OF PARTICLES OF ARBITRARY SPIN. W. A. Hepner. Phys. Rev. 81, 290-1(1951) Jan. 15. (Letter to the editor)

Much of the work in the theory of elementary particles of arbitrary spin is based on the assumption that the relativistic spin operator is of the form $t_{\mu\nu} = (\sigma_k, \gamma_k) = \text{const.} \times i(\beta_\mu\beta_\nu - \beta_\nu\beta_\mu)$, where $k = 1, 2, 3$; $\mu, \nu = 1, 2, 3, 4$. A general condition under which this form of the spin operator can be derived is presented. This condition provides a desirable short cut in the otherwise lengthy derivation of the commutation relations of the $\beta_\mu$ and in work on the solutions of the wave equation, particularly for the higher spins.

4047

ELIMINATION OF ARBITRARY CONSTANTS IN THE RELATIVISTIC THEORY OF QUANTA. E. C. G. Stueckelberg and T. A. Green. Helv. Phys. Acta 24, 153-74(1951) Apr. 10. (In French)

It is shown how the influence of undetermined constants in the integral theory of collisions (Rivier, Helv. Phys. Acta 22, 265(1949); Stueckelberg, Phys. Rev. 81, 130(1951)) can be avoided. A rule is given by which the probability amplitudes may be calculated in terms of a given local action. The integral method differs essentially from differential methods employed by other authors (Tomonaga, Feynman) in that it avoids the two sorts of diverging terms that occur in the formal solution of a Schroedinger equation, viz., the self-energy and the boundary divergencies.

4048

ON NONLOCALIZABLE FIELDS. PART I. M. A. Markov. Zhur. Eksptl'. i Teoret. Fiz. 21, 11-15(1951) Jan. (In Russian)

In Zhur. Eksptl'. i Teoret. Fiz. 10, 1311(1940)) the author pointed out that, in the vicinity of a point source, the classical field may become unobservable and void of the usual physical content; by following this line of thought he hoped to avoid the known difficulties of the field theory. This idea of "nonlocalizable" fields has since occupied various authors (Yukawa, Phys. Rev. 76, 300(1949)). An examination is made here of such forms of nonlocalizable fields which admit of a wave function outside the proper region of nonlocalizability, whereas inside that region a wave function either cannot exist or is identically equal to zero.

4049

ON THE POSSIBILITY OF SPIN MODELS. Fritz Bopp and Rudolf Haag. Z. Naturforsch. 5a, 644-53(1950) Dec. (In German)

It is shown that, in analogy with other quantum-mechanical magnitudes, spin states can be described by continuous eigenfunctions of certain differential operators. Whereas, as is known, spherical functions of half-integer indices cannot be used for this purpose because of their transformation properties, the Schroedinger angular-momentum operator of the two-body problem offers eigenfunctions for half-integer eigenvalues. From this new standpoint the Goudsmit-Uhlenbeck and the field-mechanical models of the spin are discussed. (auth)

4050

ON THE PRINCIPLE OF SPECTRAL DISPERSION IN THE THEORY OF PARTICLES WITH SPIN GREATER THAN ½. Serge Slansky. Compt. rend. 231, 892-4(1950) Oct. 30. (In French)

The application of the principle of spectral dispersion to the wave function of a particle of spin 1 or greater is not generally legitimate except for operators of which the eigenfunctions satisfy the wave equations. From this consideration, a distinction results between the density of the mean value of position and the density of probability for presence of the particle.

4051

ON THE REPRESENTATION OF WAVE FIELDS. Werner Braunbek. Z. Naturforsch. 6a, 12-15(1951) Jan. (In German)

An analysis of the concept of wave surfaces shows in what cases it is possible to represent a wave field by phase surfaces and by lines of current of time-averaged energy orthogonal to those surfaces. Such a representation is always possible in a scalar field, e.g., in the case of a sound field in liquids and gases, whereas for the electromagnetic wave field it can be used in a certain class of problems only, inasmuch as in the general case of such a field there are no surfaces orthogonal to the average energy current. (auth)

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RENORMALIZATION OF NEUTRAL MESONS IN THREE-FIELD PROBLEMS. P. T. Matthews. Phys. Rev. 81, 936-9(1951) Mar. 15.

It is shown that a finite S-matrix can be obtained to low orders by renormalization if neutral spin-zero mesons with (pseudo) scalar coupling are added to the mixture of nucleons, photons, and charged spin-zero mesons previously considered, provided that a limited number of contact interactions are introduced. A general proof for any order is not given; but it is shown that at no stage can divergences of a new form appear, requiring the introduction

of additional contact terms. Renormalization certainly fails for the pseudovector interaction, and the possibility of defining a finite S-matrix, formally, with the use of regulators, is considered. It is shown that it is not possible to do this in a manner which is both self-consistent and consistent with the renormalization of the pseudoscalar coupling. This result is related to the "ambiguities" found in the calculation of three-field problems with the use of regulators only, and is illustrated in the appendix by a detailed discussion of the two-photon decay of a neutral spin-zero meson. It is concluded that cross sections for interactions, for which renormalization is inadequate, can certainly not be calculated in this manner, and that if, in fact, such theories have any meaning, it must be possible to remove the divergences in a more fundamental way. (auth)